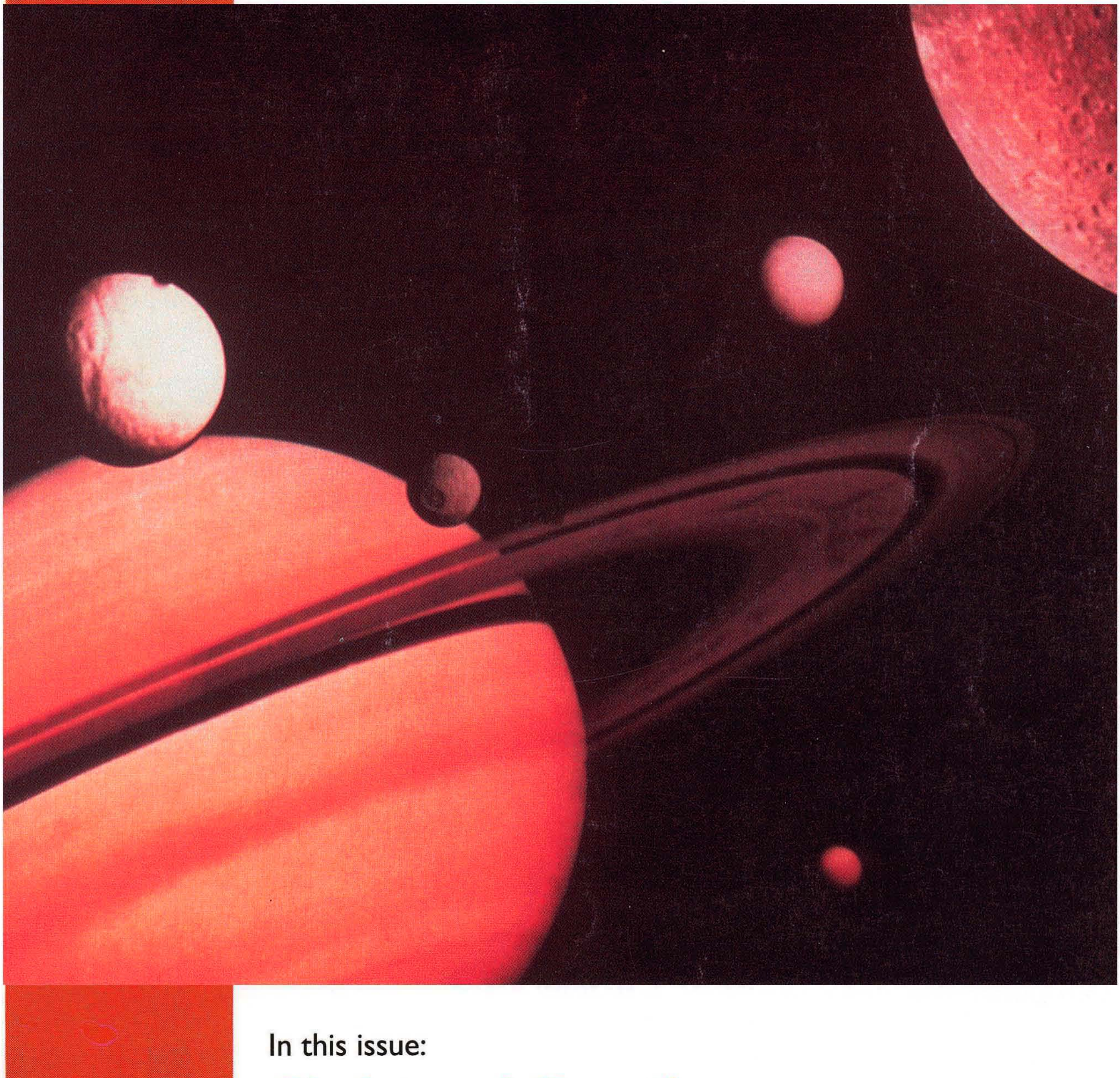
ORIGINS

• Journal of the Biblical Creation Society •

Volume 6 Number 15



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Vol. 6 No. 15
July 1993

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Writing for Origins

Origins is looking for talented new writers, particularly those who have had experience in a specialised field of science or theology, in relation to creation, and who are in agreement with the aims and basis of the BCS. In addition, writers in a popular vein are needed, but accuracy and solid content are still essential. Any manuscripts for consideration should ideally be typed, double-spaced and sent to the Editor. Notes of guidance to authors are available on request. News items that may be of interest are also sought. We now welcome articles on disk in most formats, but 3½ ″ HD, Wordperfect 5.1 is preferred; media will be returned after transfer of the file.

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Editorial

CREATIONISTS often bemoan the fact that they cannot get a hearing on radio or television. This is especially true of programmes describing the creationist interpretation of the world around us. This is one of those perverse aspects of the world. The impact of evolutionary theory on the world in terms of philosophical effects is apparent, whether it is capitalism or nationalism or communism. Other implications in terms of the limited value of human life have been described frequently. Yet, the impact of creationism is so different. It values life. It teaches that people, as individuals as well as a race, matter. Yet, there is a desire—an obsession—to keep us off the air.

However, there are opportunities. On a number of occasions members of the Biblical Creation Society have been asked to respond to questions arising, for example, from the publication of books. The input may be brief but it can be effective.

Gardens and stars

Christians often have their greatest impact by the way they live. This can also give opportunities for creationists to witness. Over the last couple of years we have heard a couple of such testimonies on the television in the popular Sunday evening hymn-singing programmes. In one, a gardener from Harrogate was complimented on his work and he gave the credit to his Creator. More recently, the programme came from Ireland. One of those interviewed was Dr. Mart de Groot, director of the Armagh Observatory. He commented on his belief in a young earth and the seven days of creation. As a result, we invited Dr. de Groot to submit a paper backing his position.

That paper is included in this issue and we thank the author for it. Cosmology is a complex area and Dr. de Groot has surveyed the developments in the research into this area. Like the rest of our authors, Dr. de Groot would not claim infallibility but he has contributed a very helpful article showing his interpretation of the experimental data in the light of Scripture. The cover photo, to complement this article, is of Saturn and some of its satellites and we gratefully acknowledge NASA's Joint Planetary Laboratory as the source of this picture.

The Bible and science

Our ultimate authority is Scripture which is infallible. Not only does creationism affect our view of man, but it is intimately related to the doctrine of salvation. The Fall (Genesis 3) is a part of the creation account and has no meaning in an evolutionary context. Human death was the result of the Fall. In due time, the Scriptures tell us, Christ died for our sins. Adam was the first man, by whom mankind became sinners. Christ was the last Adam, by Whom we are made alive. So, the Scriptures closely link creation and salvation. This theme is helpfully developed by our president, Professor Andrews. This article is a challenge to many, both those who would want to interpret Scripture in an evolutionary context and to creationists as well. He reflects the stand of the Biblical Creation Society as we have described previously: that we stand by our position on Creation because it is biblical. Our scientific analysis follows from this.

Many, who selectively choose what they believe in the Scriptures, often overlook the implications of their position. Consider, for example, the Creation account. It tells us that in six days God created the heavens and the earth and then rested from this activity on the seventh day. If we dismiss this, we must confront the dilemma that arises for us. The Ten Commandments are given by God as the moral law. In them, He says that 'in six days the LORD made the heavens and the earth ... and rested on the seventh day' (Exodus 20:11). Did He do that or not? If not, He is a liar and the moral law has no moral basis. And what about Christ Who said that the 'Sabbath was made for man.' If it was not, then He too is a liar and we have no confidence in His promises. In Hebrews 4:8–9 this Sabbath rest is linked to the eternal rest that awaits the children of God. If Genesis 1 and 2 are not true, then there is no eternal rest awaiting us. The consequences of not believing God's Word are serious.

Many, especially the editorial team, have appreciated Michael Garton's series on the Rocks and Scripture. They have been written clearly so that the layman can understand the principles and, yet, in a technically reliable way. Michael has submitted his manuscripts to fellow geologists of alternative persuasions before they have gone into print in order to ensure that they are geologically sound—even if they go against mainstream theory! This issue contains the fifth part in which he looks at dating. There is a simple practical test that the reader can apply to test some of Michael's statements. Next time you are looking at the rocks, notice the parallel strata. They may be tilted due to geological disturbance, but the continuous parallel formations are there—whereas, if there was a long time scale involved, we would expect to see erosion eating into the layers before subsequent deposition occurs.

By faith, we believe that the world was framed by the Word of God. But the eyes of faith will see some very obvious evidence for the biblical account.

J.H.J.P.

Christ and Creation

Professor Edgar H. Andrews

THE OPENING VERSES of the Epistle to the Hebrews provide a statement of biblical Christology unsurpassed in all Scripture. Since this passage is the basis of this article, I will quote it in full.

'God, Who at various times and in different ways spoke in time past to the fathers by the prophets, has in these last days spoken to us by His Son, Whom He has appointed heir of all things, through Whom also He made the worlds; Who being the brightness of His glory and the express image of His person, and upholding all things by the word of His power, when He had by Himself purged our sins, sat down at the right hand of the Majesty on high, having become so much better than the angels, as He has by inheritance obtained a more excellent name than they' (Hebrews 1:1–4)

In these verses we read that Jesus Christ is God's unique Son, sharing His eternal glory, nature and attributes. Through Him, the material universe was created 'in the beginning,' and by Him that universe is now providentially sustained. Furthermore, as 'heir of all things,' Christ is the one for whose sake all things were made. As Paul writes to the Colossians, 'All things were created through Him and *for* Him' (Colossians 1:16; emphasis added). This 'cosmic Christ' is the self-same person in Whom the Godhead stands revealed, and Who died, as a man, on the cross, to bear the sins of His people and make them His fellow heirs (Galatians 4:7; Romans 8:17).

Two things must immediately strike us. Firstly, how difficult it is for human reason to take in the sheer magnitude of these assembled facts concerning Christ. Secondly, that the Bible makes no distinction between the Christ of creation and the Christ of Calvary.

It is the second of these observations that I want to address in this article, though the first will, necessarily, permeate all I have to say.

A false dichotomy

There has developed, in Christian belief and teaching, a tendency to separate Christ's work in creation and providence from His work of redemption. Indeed, it would not be putting it too strongly to say that these two aspects of His work have been divorced in the minds of most believers and theologians. What is the evidence of this false dichotomy? It is all around us.

Firstly, in our churches and pulpits, the work of Christ in creation and providence is almost totally neglected. For many, it just seems irrelevant to gospel preaching that Christ was the one through whom creation was accomplished and by whom the natural world is upheld. What has that to do with saving sinners, they imply by their silence? Others are intimidated by the cultural climate, in which 'creation' is attributed to evolutionary processes, with God hovering in the background playing an uncertain role. To raise the issue of divine creation and providence is to raise scientific questions which the preacher may not feel qualified to answer (unless he has an appropriate Ph.D.).

This last dilemma is neatly by-passed by the idea of 'theistic evolution,' or to use a more gracious term, 'complementarity.' According to this view, everything claimed by the theory of evolution can be accepted, and need not even be discussed. It belongs to the realm of science, not religion, and we are expert at subdividing knowledge into water-tight compartments. Divine creation and evolution (they say) are complementary truths; different ways of looking at the same basic reality. In practice, this notion reduces to the statement that God used evolutionary processes to bring about the present material world-order. He was in control, but simply used natural process rather than miraculous means to establish His handiwork.

While this approach certainly minimises controversy, and keeps people happy, it presents one major problem; it is almost impossible to reconcile with an honest understanding of Scripture as the inerrant word of God. Some 'theistic evolutionists' are willing to admit this, and frankly relegate the relevant historical passages (particularly, but not solely, the first eleven chapters of Genesis) to the realm of mythology. Most conservative teachers are loath to do this, however, and instead avoid the issue altogether in their public ministries.

However, creationists (that is, those who reject evolution in favour of a miraculous creation) are equally to blame for the dichotomy to which I refer. One reason for this is that the most popular form of creationism is 'scientific creationism.' This term refers to the idea that creation by the direct (miraculous, or non-natural) activity of God can be established on scientific grounds alone, without appeal to scriptural revelation. The ostensible reason why Bible-believing creationists first adopted this concept, was that religion cannot be taught in the public schools of the USA. A non-religious alternative to evolution was therefore required, and scientific creationism served this purpose admirably. Furthermore, it is argued, if people can be convinced intellectually that evolution is wrong, and that creation must have been accomplished by miraculous means, they will be more open to the biblical message and the gospel of Christ. Scientific creationism thus serves as 'pre-evangelism.'

However, there is probably more to it than that. It seems to me that for many creationists, 'scientific creationism' is an enthusiasm which actually has little to do with a love for biblical truth. Pursuant to this, biblically conservative creationists are often found associating with some strange bed-fellows, such as Jehovah's Witnesses, and non-christians who reject evolution. On more than one occasion I have declined invitations to present the creationist position on platforms organised by sectarian and non-conservative groups and churches, only to find that some other conservative creationist has accepted. On other occasions, those inviting me to speak have backed off when I have told them that I will only present creationism in a biblical and Christological context. They wanted creationism, but not Christianity. Perhaps I am unusual in being unable to contemplate a creationism divorced from Christ and the biblical testimony.

Since, then, the dichotomy exists, what can we do to reverse it? The answer is surprisingly straightforward. We must return to the teaching of Scripture on these matters. I say that the answer is straightforward, not simple. For to present a truly biblical doctrine of Christ may require us to re-examine some of our basic theological preconceptions, and that is never easy. In the remainder of this article, I hope to point the way forward.

The Bible links creation and redemption

The dichotomy between creation and redemption that we have discussed above is not found in Scripture. The New Testament writers, in particular, are concerned to demonstrate that an intimate relationship exists between the creation and the atonement. Let me attempt to justify this statement.

Firstly, we may turn to the prologue of John's Gospel. 'In the beginning was the Word, and the Word was with God, and the Word was God ... All things were made through Him, and without Him nothing was made that was made ... He was in the world, and the world was made through Him ... as many as received him, to them He gave the right to become children of God, even to those who believe in His name' (John 1:1–12). It is evident that John is concerned to establish the creatorhood of Christ before introducing His saving work. But there is no pause, no 'change of gear,' as the Apostle passes from the one to the other. For reasons we must try to fathom, John presents the cosmic role of Christ as essential to an understanding of the incarnation and the atonement.

One clue is the use of the term 'the Word' to describe Christ. This expression tells us that God 'speaks,' that is, reveals Himself to man, through Christ, and this agrees precisely with Hebrews 1:2, 'God has spoken to us by His Son.' *The Godhead speaks, or manifests itself, through Christ, whether in creation or in redemption; thus creation and redemption must be seen as different aspects of a single revelation.* If this is so, it implies that the thing revealed, namely God's eternal purpose, is also a unity, and we shall pursue this idea in the next section.

Let us next refer to Colossians 1:14–18, where we read, 'In [Him] we have redemption through His blood, the forgiveness of sins. He is the image of the invisible God, the first-born over all creation. For by Him all things were created, visible and invisible ... All things were created through Him and for Him. And He is before all things, and in Him all things consist. And He is the head of the body, the church ... that in all things He may have the pre-eminence.'

Some, perhaps, find this passage hopelessly confused, mingling as it does teaching on the creation and sustenance of 'all things,' with the atonement and the doctrine of the church. But if we think that way it is we who are confused, for in Paul's gospel these diverse truths are inseparable. The unifying theme is the pre-eminence of Christ, and the implication is that creation, providence, atonement and the church are all aspects of a single seamless plan, that God is working out through Christ.

Finally, we may return to Hebrews 1:1–4, which has already been cited. There we are told that the one Who 'purged our sins' is also the 'heir of all things, through whom also [God] made the worlds.' Once again, the link between the death of Christ, the creation and God's final purpose is deliberate and unmistakable.

Perhaps the reader has at some time bought a piece of furniture that is 'flat-packed,' and has to be assembled at home. When the package is opened, and its contents laid out, it may be very difficult to see the relationship between the many different parts, large and small, which make up the kit. We may struggle for a while before, as a last resort perhaps, referring to the instructions. There we see the whole plan made clear. What was confusing, now (in theory at least) becomes plain.

Similarly, if we isolate the different aspects of the work of Christ (in creation, providence, incarnation, teaching, miracle-working, death, resurrection, ascension, redemption, return, judgement, grace and glory), we can become confused. Concentrating on one or other of these aspects, while ignoring the rest, may even lead us into error. In order to relate each aspect to the whole, it is essential that we see the master plan, namely, God's eternal purpose in Christ.

God's eternal purpose

If we think merely in terms of time, of world and human history, or of personal spiritual experience, it is clearly impossible to relate creation to the death of Christ. Yet, as we have seen, this is what the Bible does again and again. Our starting point, therefore, must be the eternal nature of God's purpose. What can we say about that purpose?

Firstly, it *is* an eternal purpose. No part of it remained uncharted when time began. It owes nothing to chance or improvisation. Writing to Timothy, Paul declares, 'God ... has saved us and called us with a holy calling, not according to our works, but according to His own purpose and grace which was given to us in Christ Jesus before time began' (1 Tim. 1:8–9). Likewise, to the Ephesians he writes, '[God] chose us in [Christ] before the foundation of the world, that we should be holy and without blame before Him in love, having predestined us to adoption as sons by Jesus Christ to Himself, according to the good pleasure of His will' (Ephesians 1:4–5).

Secondly, God's final intention is that the church (that is, those whom Christ has redeemed) should share His eternal glory as the bride of Christ (see Ephesians 5:25–27; Revelations 21:2–3, 9–11). It is in this sense that the church is 'the fullness of Him [Christ] Who fills all in all' (Ephesians 1:23). As human marriage is a fulfilment of the human potential for love and fruitfulness, so the marriage of Christ to the church He redeemed and sanctified by His blood, is the fulfilment of the divine potential for love and grace, *a potential that could not otherwise be realised.*

Thirdly, if this was God's purpose in eternity past, it could only be actualised through the creation *and fall* of man. Creation was necessary, of course, that man might exist. Notice how mankind is set apart from the remainder of the created order, whether animate or inanimate, by being made 'in the image of God' (Genesis 1:26–27). This was true of no other created beings, even the angels. This immediately suggests that the physical universe was created specifically as a home for man. If this is so, why is the universe so vast? The solar system would have sufficed for this purpose! Psalm 19 provides the answer. 'The heavens declare the glory of God; and the firmament shows His handiwork.'

Just as the physical creation was necessary, so also was the Fall. For without the Fall, mankind would have needed no redemption, no grace. The redeemed are adopted 'as sons by Jesus Christ ... according to the good pleasure of [God's] will, to the praise of the glory of His grace.' Without sin, there is no grace. Without grace, there is no glory. Without glory there is no praise.

Fourthly, we are told, God's eternal purpose will be immaculately fulfilled. There is complete certainty that it will not fail. 'God is not a man, that He should lie, nor a son of man, that He should repent. Has He said, and will He not do it? Or has He spoken, and will He not make it good?' (Numbers 23:19). We have 'obtained an inheritance,' adds Paul, 'being predestined according to the purpose of Him Who works all things according to the counsel of His will' (Ephesians 1:11). And this 'predestination' must therefore have its intended outcome. So sure of this is the Apostle that He speaks of the whole panorama of redemption as if it has already been accomplished (as indeed it has, from God's timeless perspective). 'All things work together for good to those who love God, to those who are the called according to His purpose. For whom He foreknew, He also predestined to be conformed to the image of His Son, that He might be the firstborn among many brethren. Moreover whom He predestined, these He also called; whom He called, these He also justified; and whom He justified, these He also glorified' (Romans 8:30).

Fifthly, in order that God might indeed be sovereign in redemption, it was also necessary that He be sovereign over the events of human history and experience, for otherwise there would be factors affecting the gospel which would not be under His control. As Paul tells the Athenians, '[God] has made from one blood every nation to dwell on all the face of the earth, and has determined their pre-appointed times and the boundaries of their habitations, *so that they should seek the Lord* ... for in Him we live and move and have our being' (Acts 17:26–28; italics added).

But if God is to sovereign over human history, He must also clearly be in control of the physical world on an ongoing basis. The deistic idea that God started-up the universe, but then left it to run on 'autopilot,' governed only by the operation of natural law, simply cannot meet this requirement. Although all theists reject the classic Deism, there is considerable danger in 'theistic evolution' of embracing hidden deistic principles. For, to be logically consistent, theistic evolution requires God to act only through natural process, and thus imprisons Him within the natural laws that He has ordained.

However, Hebrews 1:3 tells us that Christ is 'upholding all things by the word of His power,' and Colossians 1:17, that 'in Him all things consist.' That is, God rules the universe and all that occurs within it, providentially through Christ. Natural law is not some self-standing system, having an existence apart from God, but is rather the expression of the mind of Christ in 'real time.' (Remember that in all things the Godhead is manifested through Christ, the second Person). Thus we see the necessary link between the sovereignty of God in the history and experience of redemption, and His sovereignty over the natural world in providence. How often in the Bible do we find examples of this in the direct experience of God's children! As Paul reassures the Philippians, concerned for his safety; 'I want you to know, brethren, that the things which happened to me have actually turned out for the furtherance of the gospel' (Philippians 1:12).

To summarize, therefore, we see that the eternal purpose of God represents a plan that necessarily embraces (and thus unifies) all the apparently diverse aspects of the work of Christ. Election, creation, providence, sovereignty, atonement, the gospel call, adoption, the church, sanctification and glorification, are all irreplaceable threads in a single tapestry. And the image on that tapestry is Christ.

The implications

Finally, what are the practical implications of all this? I suggest the following examples, which are by no means exhaustive.

1. If we accept what Scripture has to say about the scope of Christ's work, it will affect both our appreciation and our presentation of the gospel. We shall see that only a gospel of free and sovereign grace is consistent with the biblical testimony concerning God's flawless eternal plan. Any 'gospel' which gives man a part in determining

whether or not he will be saved, cannot be reconciled with this testimony.

2. In understanding God's eternal purpose, we shall see that creation and providence are doctrines of equal importance to those of atonement and regeneration, for they are all necessary means to the same end, namely the fulfilment of that purpose.
3. If this is the case, then it becomes vitally important to define clear biblical doctrines of creation and providence; we can no longer treat these matters as side-issues which can safely be neglected. In particular it becomes necessary to confront atheistic views of origins, and even theistic evolution, with its deistic tendencies which give no place to Christ. The doctrine of creation is an important aspect of the gospel of Jesus Christ.
4. We shall also learn to limit 'scientific creationism' to its one legitimate use, namely the refutation of scientifically false evolutionary claims. Scientific creationism makes no contribution to biblical understanding or evangelism, since it has no place for Christ, 'in whom are hidden all the treasures of wisdom and knowledge' (Colossians 2:3).
5. Above all, we shall become more Christ-centred in our thinking and in our creationism. We will be wary of promoting creationism outside of a biblical framework, for that will detract from the gospel rather than further it. Perhaps for some who read these words it will even be necessary to ask, 'Am I really a Christian, or merely a creationist without Christ?'

THE AUTHOR

Edgar Andrews is Professor of Materials in the University of London at the Queen Mary and Westfield College. He is an internationally known expert on the science and technology of polymers with over one hundred scientific papers and books. We are pleased to say that he is also President of the Biblical Creation Society and chairman of Evangelical Press. He has written several books on creation and evolution.

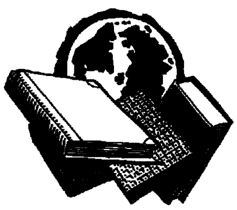
Review

The Genesis Debate: Persistent Questions About Creation and the Flood, edited by Ronald Youngblood. Baker Book House, Grand Rapids, Michigan 1990, 250pp., £10.50

Reviewed by Paul Garner

THIS book takes the form of a series of written debates on eleven separate questions related to Genesis, specifically regarding the creation-evolution controversy. Each question is posed in such a way that two authors can debate it—one arguing in the affirmative, the other in the negative. For instance, 'Did people live to be hundreds of years old before the Flood?,' and 'Was the earth created a few thousand years ago?' The format highlights the often confrontational nature of the creation debate, with each page of the book divided in two, both author's contributions appearing on the same pages.

The introduction to the book, by editor Dr. Ronald Youngblood of Bethel Seminary West, San Diego, informs us that all the participating authors are 'committed to the full inspiration and authority of Scripture' and have attempted to give 'thoroughly biblical answers' to the questions under discussion. However, from the widely different approaches represented in this book it seems clear to me that belief in the 'inspiration and authority of Scripture' meant different things to different contributors. In the opinion of this reviewer, some of the authors come perilously close to denying in practice what they assert in theory.



Some of the contributions are excellent. Steve Austin's essay on the global extent of the Flood is one example (Dr. Austin is the Chairman of the Geology Department at the Institute for Creation Research). Another is Terence Fretheim's contribution on the length of the Creation days. Fretheim argues convincingly that the author of Genesis intended his readers to understand that the Creation Week consisted of 24 hour days, the same as those we now experience. This is all the more interesting when one realises that Fretheim himself is not a believer in literal six day creation, but prefers an 'accommodationist' position (p.33).

Other essays in this collection are not so impressive. One author says, 'One does the Bible an injustice when he imposes modern ideas upon it' (p.97) and admits that 'there are all sorts of discrepancies between the biblical accounts of creation and the evolutionary theory,' yet he writes, 'The creation process is best described by the evolutionary theory' (p.107). Donald Boardman argues for a local Flood, and says, 'The Scriptures do not state how long Noah was involved in making the ark and assembling the animals to be its cargo. Bringing the animals from the far corners of the earth requires considerable time' (p.221). But the Bible says that no collection by Noah was involved! It was God who brought the animals to Noah (Genesis 6:20; 7:9, 15). Other contributions, including the essay arguing for a non-chronological interpretation of the creation account, and the essay arguing that the great ages of the patriarchs (Genesis 5 and 11) are 'theological statements' and not historical data, I found equally unconvincing.

Nevertheless, this is a stimulating book. The case for what some may regard an excessively literal approach to Genesis is made strongly. Well worth reading!

Genesis and Cosmology:

Can we find harmony?
Do we need other interpretations?

Mart de Groot

THE CURRENT scientific picture of the origin of the Universe seems at odds with the Genesis account. Is this a serious problem for those who believe that the Genesis account is reliable? Are there ways to harmonize the two accounts? Or should we be looking for alternatives to the so-called Standard Model for the origin of the Universe?

In this article I present some thoughts that suggest answers to the above questions along the following lines: Most of the apparent problems can be solved by realizing that the so-called Standard Model has its weaknesses and allows other models and other interpretations; on a number of scores it is possible to harmonize the two accounts, because both leave enough room for accommodating a wider view; on other scores harmony seems impossible and there is a need for considering alternative cosmologies, especially creation by God.

Concepts of time

Astronomers have conclusively shown that the Universe is very large by any standards. Yet, here is tiny man on a rather small planet orbiting a not particularly impressive star. That star, our Sun, is one of some one hundred thousand million in our Milky Way Galaxy. A galaxy of which there are about as many as there are stars in our Milky Way. This tiny man on this tiny planet has constructed instruments which allow him to study a substantial part of this large Universe. And as our knowledge of the Universe reaches out to farther and farther objects, it seems as if we are penetrating ever more into the very realm of the gods.

Questions like, How large exactly is this Universe?, Did it have a beginning?, and if 'yes,' When? and, How?, are therefore natural questions asked by people who look up at the stars and want to know what is behind them. Since the invention of the telescope and its application to astronomical observations in the early years of the 17th century we think we have made good progress towards answering the first of these questions. We can study the Universe as it is today and develop reasonable ideas about its size and structure. It is more difficult to give answers to the other questions. They relate to things of the past, most likely of a very remote past, which no human being has ever witnessed and knowledge about which can, therefore, only be obtained through scientifically indirect methods.

This remoteness in space and in time, however, has not stopped man in his investigation and from time immemorial there have been, first, speculations and, later, observations and calculations about the possible age of the Universe and the way it came into existence. However, since all measurement of time is based on the measurement of change, and since long intervals of time are best measured by slow changes, man has found that the time covered by his own existence is so short that slow changes are often imperceptible and their accurate measurement over this relatively short period difficult to achieve. This is aptly illustrated in the Bible when the scoffers of the day remark that 'Since the fathers fell asleep all things continue as they were from the beginning of the creation' (2 Peter 3:4).

It took man many centuries before he was prepared to adopt a way of thinking that included slow changes in nature. One of the pioneers of this new line was Georges-Louis Leclerc, Comte de Buffon, who, in the middle of the 18th century, assuming that the Earth had slowly cooled down from an originally molten state, calculated that the Earth must be 74,832 years old.

It wasn't long before further steps were taken. In 1785 James Hutton formulated the main dictum of uniformitarianism, 'the past history of our globe must be explained by what is seen to be happening today,' and in 1859 Charles Darwin published his *Origin of the Species.* While, at first, the ideas about long geological periods and slow biological evolution could not be supported by actual measurements of long periods of time, this changed around the turn of the century. In 1896 Henry Becquerel discovered radioactivity and 13 years later Lord Rutherford developed the new technique of radio-dating. Chemical elements were seen to be decaying, to be having a finite existence. Knowledge about the rate of their decay allowed a determination of their age. This impermanence, of course, raised questions in the camp of those who had always believed in the intransient character of the chemical elements, especially since the old claims of alchemy had been laid to rest.

There was, however, a deeper question that was asked as a result of these developments. Now that it had been shown that many chemical elements come to an end, do they also have a beginning? And, when and where lies that beginning of the elements? The answer came from unexpected quarters. In the first half of the 20th century astronomers discovered that the energy which stars radiate comes from nuclear processes deep in their interiors and that these nuclear processes are able to build complex atoms from relatively simple ones. By the middle of this century this led to the astonishing idea that all chemical elements more massive than beryllium are formed inside stars.

The Standard Model

Of course, this did not answer all questions. Soon people were asking the old questions with renewed confidence that answers might be forthcoming: Where do stars come from?, and later, Did the Universe have a beginning? and if 'yes,' When? and, How? It is one of the greatest stories of astronomy how in the second half of this century answers to all these questions were formulated in various cosmological theories. Among these theories, the one that has attracted most supporters is the 'Hot Big Bang' model. According to this so-called Standard Model, the Universe started some 15 thousand million years ago with a very rapid expansion, called inflation, of very hot, very dense 'primordial matter.' As a result of the expansion the temperature dropped and elementary particles like electrons, positrons, protons and anti-protons, neutrons, and finally nuclei of hydrogen, helium, lithium and beryllium formed. During the first 300,000 years matter and radiation were properly mixed, but when the temperature reached 3,000 K the Universe became transparent and matter and radiation 'decoupled.' Finally, stars and galaxies were formed[1].

The reason why this model is also called the Standard Model is mainly due to the fact that it is more consistently supported by astronomical observations than any other theory. Among these observations three are considered especially important. They are:

i. the observation that almost all galaxies show a so-called redshift;
ii. the existence of a general radiation with a temperature of about 3 K, the so-called microwave background radiation (MBR);
iii. the observed cosmic abundances of hydrogen, helium, lithium and beryllium.

Of these, the redshifts were found before the standard model was conceived, at a time when cosmological ideas had not yet been developed to a very great extent. Probably at least partly because of this, redshifts have a larger element of philosophy in their interpretation than the other observations.

During the eighties the standard model had lost some of its popularity, mainly because certain observations were casting doubt on two of its main pillars, the redshifts and the MBR. In the case of the redshift determinations, the disturbing elements are the apparently discordant redshifts of many galaxies and quasars (as exposed, *e.g.*, by Arp, 1987 and references therein), and the possibilities for non-cosmological redshifts (summarized, *e.g.*, by Narlikar, 1989). Redshift observations and some of the problems involved in their interpretation will be discussed in the next section.

In the case of the MBR, after its discovery and early agreement with theoretical predictions, there was a decline in its acceptance as solid support for the standard model due to the fact that increasingly accurate measurements failed to detect the inhomogeneities that the Universe's large-scale structure suggested should be present (*e.g.*, Schwarzschild, 1990). However, hopes that all would be well with the standard model were boosted by the recent announcement of inhomogeneities in the MBR; this will be dealt with later in this article.

Redshifts

The question of whether galaxies were objects in our Milky Way or were other milky ways (galaxies) at large distances had been the subject of a celebrated debate in 1921. The conclusions to be drawn from that debate were not altogether clear, but the matter was settled in 1924 when Hubble studied Cepheid variable stars in other galaxies and proved unambiguously that the majority of observed 'nebulæ' (as all nebulous objects including the external galaxies had been called until that day) were indeed at great distances outside our Galaxy.

Hubble and others then proceeded to observe many galaxies and found that almost without exceptions they showed red-shifted spectral lines which seemed like Doppler shifts, *i.e.* they seemed the result of receding movement of the galaxies as a whole. There are at least two serious objections against the way this interpretation was arrived at: it includes a number of philosophical assumptions which should not be present in a purely scientific process; furthermore, while it assumes that the observed redshift is caused by the Doppler effect, one should not forget that there are other ways in which redshifts can be produced.

Anyhow, by the end of the 1920s, when Hubble had enough observations to begin thinking about their possible interpretation, he was already convinced of the large distances of the galaxies. What he saw amounted to increasing redshifts for galaxies at increasing distances from the Sun. Hubble, however, was careful not to call them Doppler shifts, because that would have implied an interpretation. He called them 'apparent velocity-displacements,' thus leaving open the way they should be interpreted.

At the same time, though, he could not escape the challenge of interpreting his observations. To do this he needed a model of the Universe into which his observations could be fitted. There were three different cosmological models in those days. These were models by Lemaitre, Milne, and Zwicky. Lemaitre's and Milne's models were both recessional, *i.e.* they included an expanding universe, in one form or other. Zwicky's model was non-recessional.

The choice between the different models was complicated by the fact that nebulæ at large redshifts could not be measured properly because of the faintness of their images produced by the instruments of those days. In their analysis, therefore, Hubble and Tolman (1935) did not have the benefit of a long look-back time and discrepancies caused by the curvature of space (and predicted by the Theory of Relativity) could not really be detected. However, they did find discrepancies and attributed them to space curvature. In this, they discarded other possible causes for these discrepancies which, had they taken them into account, would have led them to the conclusion of a non-recessional universe, which would have fitted the observations better and without the need to introduce effects that were unobservable at that time. However, although the observational evidence pointed towards non-recessional models of the universe, in subsequent papers Hubble showed a clear inclination towards recessional models and he finally concluded that the universe must be expanding.

Hetherington (1971) has explained in detail how Hubble arrived at this conclusion. His major reason seems to have been one of deep philosophical significance in that he assumed two very fundamental principles: General Relativity and the Cosmological Principle. Because Zwicky's theory did not fit the prediction of an unstable universe made by the theory of General Relativity, and because it introduced so-called new physics to explain new observations, Hubble rejected Zwicky's theory in spite of the indications to the contrary of his own observations. Thus, the cornerstone of one of the most interesting and important theories concerning the origin of everything was laid on a philosophical foundation. This fact is often forgotten and I have found it appropriate to recall it here because scientists often accuse creationists of committing this kind of 'mortal sin' in other areas.

The fact that the Standard Model has a philosophical foundation, of course, does not imply that it is necessarily flawed. However, in a society that aims at understanding the Universe in purely physical terms, the Standard Model should at least be looked upon with a good dose of suspicion. In principle there are other mechanisms that can produce redshifts. They have been listed and evaluated by Narlikar (1989). Although some of these do not seem to harbour much promise, various possibilities remain open, encouraging the seeker for the truth about the origin and structure of the Universe not to hesitate to investigate alternatives to the Standard Model.

The cosmological principle

It is good to remind ourselves that, in speaking of the Universe, we are really referring to the Visible Universe only. The actual Universe may be infinitely larger but, by definition, we cannot know anything of what happens beyond our cosmological horizon. The Cosmological Principle has been invoked to extend our knowledge of the Visible Universe to the Universe as a whole. In its simplest form it states that the Universe looks the same from every location within it.

At first sight it may seem that the increasingly large redshift of the more distant galaxies would lead to the inescapable conclusion that the Earth is the centre of an expanding Universe, and therefore contradictory to the Cosmological Principle. However, this is not really a problem. An expanding universe in which the rate of expansion increases linearly with distance does look the same from every location within it. However, the Cosmological Principle is a purely philosophical assumption which is unfalsifiable because we simply do not have the possibility to move to a sufficiently different location in space to check the aspect of the Universe from there.

In fact, at whatever scale one looks, the Cosmological Principle does not seem to hold. The Solar System looks very different from different locations within it and the Milky Way with its flattened disk and spiral arms does not look the same from everywhere. Looking at the galaxies in the Local Group, in the Local Supercluster, or at even larger distances, one sees very inhomogeneous distributions of matter. Of course, one can maintain that all this unevenness will smooth out if one were to look at larger scales. With our sophisticated astronomical instruments, we seem to have been able to see almost as far as we possibly can; *e.g.* for a redshift $z = 4$ we see galaxies at a time when the Universe was only 20 % of its present size. This means that we can investigate the Universe over a substantial fraction of its entire diameter. The fact that we have seen structures on ever larger scales and not much of the smoothness postulated by the Cosmological Principle (Schwarzschild 1990), does not augur well for its ultimate triumph for the true description of the universe. However, in order for stars and galaxies to form subsequently, at the moment of decoupling of matter and radiation, small density inhomogeneities from which later stars and galaxies could grow must already have existed. If the Cosmological Principle does not hold, the Standard Model, which is based on it, is also in trouble. Thus we find a second reason to consider alternatives to the Standard Model: the Cosmological Principle, which is one of its cornerstones, despite its philosophical attraction in some quarters, is not a very safe foundation to build on.

It is interesting to think for a moment about the biblical view of the Cosmological Principle, especially with respect to the Earth which, clearly, has such a special place in God's Word. Is Earth's special place contradictory to the Cosmological Principle? Probably not; Earth's special status is derived from its moral condition. Considered as a planet in the physical sense, the Earth may not be that unique at all despite the definite impression we get that many of the heavenly bodies were created especially for the benefit of the Earth and its people (see Gen. 1:14–17, 'lights' and 'signs'). In fact, astronomy has various arguments in favour of an abundance of planets throughout the galaxies (see, *e.g.*, Huang 1959). The problem for those who practise physical cosmology is twofold: the apparently logical assumption of the Cosmological Principle is a deeply philosophical one, and it may not be true at all.

The age of the Universe

However, before discarding the Standard Model, we must consider another of its interesting aspects. The possibility that the Universe is actually expanding is an interesting one, also for the creationist. Because, if the Universe is expanding today, then one can think of times past when it must have been smaller. Going back in time far enough, one then arrives at an epoch when all things in the Universe were at their closest together just before they were driven apart by the Big Bang. This would point to a definite beginning in time of the Universe, an idea very much in harmony with the Genesis record.

Of course, there are also worrying aspects to the Big Bang. For creationists the biggest problem is the long time that allegedly has elapsed since the inflationary expansion set everything going. It is not immediately obvious that there is any possibility of reconciling the 15 or so thousand million years since the Big Bang with the 6,000 or so years since the events reported in Genesis 1. The problem has some similarity to the time problem in geology. Radio-dating methods have given high ages for many, especially Pre-Cambrian, rocks; ages which, despite their being subject to the problems inherent in our lack of knowledge about initial clock settings, seem reliable but which cannot be reconciled with a 6,000-year time scale and have forced us to accept a high age for the Earth as a planetary body.

I think that the Genesis record does not contradict such a conclusion. Genesis 1:1 simply says: 'In the beginning God created the heavens and the earth.' There is no precise indication of time. The emphasis is on who created—our omnipotent God—more than on when this was done. The next verse seems to suggest that the Earth existed as a planet—lifeless, dark, and covered by water—already before the other events described in Genesis 1 took place. From verse 3 we then read the account of the Earth's preparation as a habitat for life and the creation of life some 6,000 years ago. The partial lifting of a dense cloud on the first day lighted the Earth, but the Sun, Moon and stars, although already there, could not yet be seen from the Earth. The light must have been similar to that on an overcast day. On the 4th day that cloud was lifted completely and the Sun, Moon and stars became visible from the Earth's surface. Therefore, they are described as coming into existence on the 4th day.

Verses like Job 38:9—an original Earth with a cloud garment wrapped in 'thick darkness'—and 2 Peter 3:5—the creation of the Earth 'out of water'—also seem to imply something existed before creation week. This is not to say that the brief Genesis account leaves no room for questions. Also, a number of interpretations are possible. When selecting one interpretation above another we cannot be dogmatic and it should be remembered that the problems of creation week arise more from a lack of information than a matter of contradiction between science and revelation both properly understood.

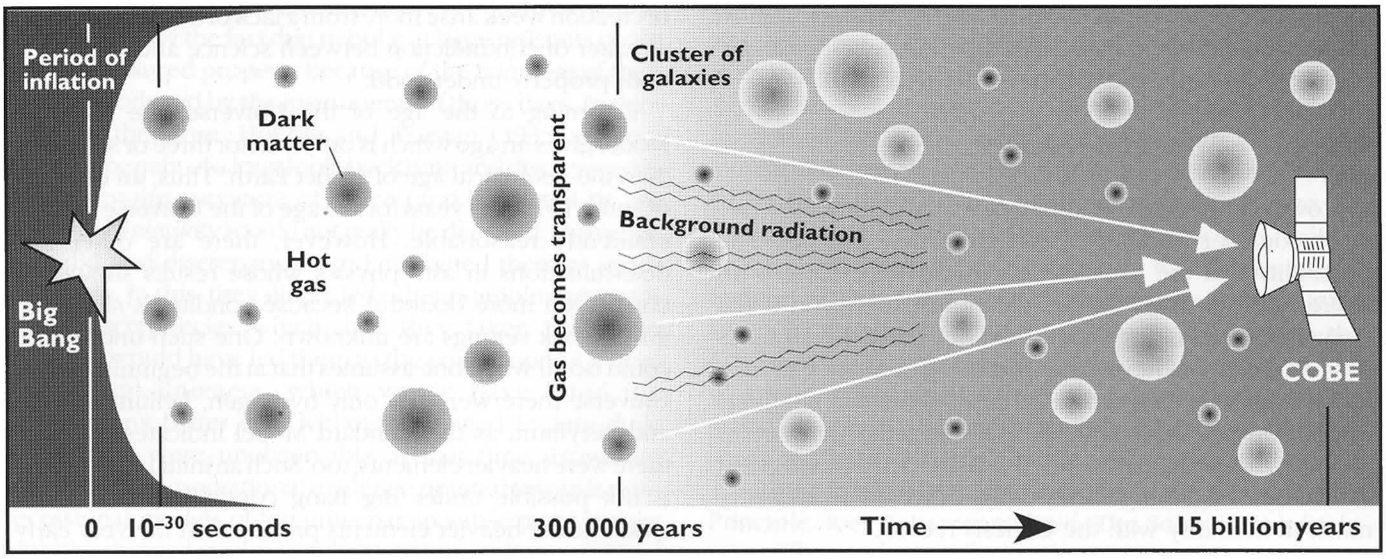
Returning to the age of the Universe, the Standard Model gives an age which is only a factor three or so higher than the geological age of planet Earth. Thus, an estimate of some 15 billion years for the age of the Universe sounds eminently reasonable. However, there are other age determinations in astrophysics whose results should be considered more doubtful because conditions similar to initial clock settings are unknown. One such uncertainty could occur when one assumes that at the beginning of the Universe there were not only hydrogen, helium, lithium and beryllium as the Standard Model indicates, but that there were heavier elements, too. Such an initial enrichment is not possible under Big Bang conditions. There, the quantities of heavier elements produced in the very early stages are negligibly small and they can have been produced only inside stars (Wagoner, Fowler and Hoyle, 1967). The results of astrophysical observations, too, indicate quite unequivocally that, within the context of the Standard Model, any primordial component in the abundance of elements other than H, D, ^{3}He, ^{4}He and ^{7}Li simply does not exist.

Note, that this does not necessarily prove that these primordial elements must have been produced in the hot Big Bang of the Standard Model. There are several other mechanisms of baryosynthesis (Schramm, 1991), even at temperatures as low as 10^{15} K (Linde, 1991). (Compare this with the temperature of 10^{32} K supposed to have existed at the time of the Big Bang.) If any of these other mechanisms has been operative on a large scale, the abundance of the heavier elements at the time the first stars were formed could have been much higher than the Standard Model predicts, and problems similar to the clock setting in radio-dating methods arise. If this were the case, many age calculations done by the theory of stellar evolution would be invalid.

Here we find the interesting fact that both in geology and in cosmology some dating methods are capable of giving reliable results which, even when they give high ages for certain objects, are not contradictory to the Bible record, while, at the same time, there are other such methods whose results must either be received with much caution or be rejected altogether. Unfortunately, mostly because we are dealing with events that happened a very long time ago, it is not always easy to decide which methods are the more reliable ones. Therefore, even when there are good arguments in favour of an 'old' Universe, its precise age remains difficult to determine and there is room for considering alternative cosmologies.

The echo of the Big Bang

In the Big Bang scenario, the Universe started with an extremely high temperature and cooled as it expanded. After about 300,000 years the temperature had gone down



The Big Bang scenario—based on the illustration published in the New Scientist, *2nd May 1992*

to 3,000 K. At that moment, matter and radiation became decoupled, *i.e.* the density and temperature of the Universe had become so low that the two were no longer intimately connected and in equilibrium with each other. Since that time the Universe has expanded a thousandfold in each direction and stars, galaxies, planets and man have come into being. Meanwhile the background temperature of the Universe has now dropped to a mere 3 K.

This very cool radiation is also called the 'echo of the Big Bang.' It was discovered in 1964 by Penzias and Wilson who were awarded the Nobel Prize for this discovery. Also called the 3 K microwave background radiation (MBR), its detection was one of the main reasons why most scientists accepted the Standard Model as the true description of the Universe. However, in order for stars and galaxies to form subsequently, at the moment of decoupling of matter and radiation, small density inhomogeneities from which later stars and galaxies could grow must already have existed. The corresponding fluctuations (anisotropy) in the MBR have been predicted by theory to be about one part in 10^5 over angular scales of 1.

Until recently, however, all observations have found the MBR to be extremely isotropic, even from widely differing directions. This had always been considered a serious setback for the Standard Model for two reasons. First, regions of space so far apart that there could not have been a causal connection since the moment of the Big Bang still show the same temperature. This problem was solved by postulating a so-called 'inflationary' phase during the very first moments after the Big Bang. This phase of very rapid expansion led to a very homogeneous, isotropic Universe free from such complications as magnetic monopoles, primordial black holes and others (Guth, 1981).

Second, while the presence of isotropy was puzzling, the lack of it was worrying. The existence of large-scale structure in the Universe can only be understood if there were density fluctuations in the early Universe. These should be seen today as inhomogeneities in the distribution of the MBR over the sky. Though the expected fluctuations are small, until recently they had not been detected despite a large number of thorough searches (Schwarzschild, 1990).

For the survival of the Standard Model, a solution to this MBR problem was of vital importance. Therefore, a special satellite named COBE (Cosmic Background Explorer) was launched in 1990. COBE's first measurements showed the customary perfect black-body distribution of radiation with a temperature of 2.735 K with deviations less than one quarter of one per cent. More recently, however, with the accumulation of more data, it has become clear that the MBR is not completely smooth. There are temperature fluctuations with an amplitude of 16 x 10^{-6} K, very close to the theoretical prediction (Goss Levi, 1992). From this point of view the COBE measurements agree with the present-day large-scale structure of the Universe as predicted by the inflationary Standard Model. The recent measurements do not, however, point unequivocally to one particular cosmology (nor even to one particular group of cosmologies) as the only valid description of the Universe's origin and structure (Flam, 1992).

The announcement of the discovery in April, 1992, caused quite a flurry of publicity. Many newspapers and other media reports asked the question, With this fresh confirmation of the Standard Model, does God still fit into the picture, and how? The COBE team leader George Smoot was quoted as saying, 'If you're religious, it's like seeing God.' To put all this in perspective, it should be understood that these measurements are at the limit of detectability and would need some independent confirmation before they are widely accepted. Furthermore, COBE was not designed to answer any religious questions. Be this as it may, the detection of these fluctuations is a remarkable achievement. The still existing discrepancies require a deeper understanding of the way galaxies and clusters are formed, but another piece to the cosmic jigsaw and to scientists' attempts to construct a 'theory of everything' has been found. The existence of God is not in question here; *i.e.* as long as the search for a theory of everything is limited to the inanimate, physical world.

Fine tuning of the Universe

Another interesting characteristic of the Universe which we have become aware of as a result of the claims of the Standard Model, and one creationists have often been quick to point out and try to take advantage of, is the fine tuning of its physical characteristics. Consider the force with which the Big Bang went off. If this force was too large, the Universe would expand very quickly to a state of very low density where there would be too little interaction between its constituents to form stars and galaxies. On the other hand, if the force behind the initial expansion was too small, the total mass of the Universe would have slowed down the expansion long before now and the Universe today would either be contracting or would have collapsed already. Neither of these two possibilities corresponds to the real Universe as we know it. This means that the force of the Big Bang had to be very finely tuned.

In order to appreciate how finely tuned, we must realise that the final fate of the Universe as far as its expansion is concerned depends entirely on the density of the matter within it. If the density is high, the Universe will stop to expand at some time in the future and then begin to collapse. If the density is low, the Universe will expand forever. The critical density which divides these two possibilities is about 5×10^{-30} g cm^{-3}, which corresponds to the extremely low density of about 3 hydrogen atoms per m^3. By determining the actual density of the Universe it is thus possible to make a good guess about its future. Such an estimate is not easily made and values given by different scientists and obtained with different methods vary. But all such estimates give values between the critical density and one-tenth of its value. It is, therefore, fair to say that the actual density of the Universe is quite close to the critical density. This remarkable coincidence has been difficult to explain and is called the 'flatness' problem.

However, given the uncertainty about the actual density of the Universe, it is impossible to say whether the Universe will continue to expand forever or whether it will come to a halt and collapse again. This is remarkable because in the early Universe with its extremely high density, at each moment in time the density must have been very close to the critical value at that time. In fact, the tuning at a very early epoch must have been much more precise than the present one: accuracy of 1 part in 10^{49} is required. This is not fine tuning, this is extremely fine tuning! If the original density had been slightly higher, the Universe could not be expanding today; it would already have collapsed. Had it been slightly lower, then today's density would not have been enough for stars and galaxies—and, as proponents of the Standard Model like to say, for man—to form.

It is interesting to note that this near equality of the actual density and the critical one has inspired many cosmologists to believe that these two values are indeed identical and that, therefore, the Universe will just about continue to expand for ever. One can easily understand how such an opinion comes to be expressed. The fact that we are here seems to become a highly unlikely condition in a Universe which has only a relatively narrow 'window' for the formation of man. Many people would not want to accord such a very special place to mankind.

While it must be pointed out that the assumption of a flat Universe has a strong philosophical bias, the interesting thing is that it has even been possible to construct a theory which explains why we are in this very situation. The inflationary universe scenario introduced in 1981 by Guth (1981) and later modified by Linde (1983) took care of the flatness problem by delivering a universe which is indistinguishable from a flat one, *i.e.* it predicts that the present density of the Universe must be very close to its critical value. However, inflation will only work if a very special set of initial conditions is met. Thus, it carries with it its own fine tuning (Narlikar, 1988).

The above argument, and similar ones based on other instances of fine-tuning (*e.g.*, the fine balance between the amounts of matter and antimatter created, the strength of the weak interaction and the coincidences of nuclear energy levels: Gribbin and Rees, 1990) can also be reversed. One could say that the Universe is as it is because we are here to observe it. This is one form of the so-called Anthropic Principle[2]. For creationists this may seem to offer a fantastic opportunity to practice some natural theology. One would first point out the near impossibility of this fine tuning and then proceed to argue that it can have been achieved only if there was a higher power responsible for it.

Those who would try to get some creationist mileage out of this argument should consider, however, that it is impossible to prove the existence of God through scientific arguments. This is so because, as Barrow (1990, p. 365) argues, such arguments have to start with certain assumptions and then proceed by deduction to infer the existence of God. Such a process does not really lead to firm inescapable conclusions, but rather to choices about believing or not believing the starting assumptions. While the Anthropic Principle identifies certain necessary conditions for the existence of life, these do not guarantee that life will actually exist. Also, the fine balancing seemingly implied in the Standard Model could disappear if the Big Bang never happened or if science arrives at a more complete understanding of its mechanism and can explain how the coincidences occurred. Finally, we must grant science time to find its own tuning mechanism. While at this moment an action by the Creator may be invoked, one cannot be sure that this is a scientifically safe long-term position to take. The absence of a tuning mechanism today cannot be construed to be evidence that such a mechanism does not exist.

However, as Barrow (1990) concludes, while the Anthropic Principle cannot be used as a proof of God's existence, it certainly does not contradict such a conclusion. Personally, I am fully confident that further discoveries in the realms of science, when properly understood, will give us further evidence that the origin of the Universe cannot be explained by physical science only. In the end God and His Word will be vindicated.

How the Universe began

While there seems to have been some success in answering the question about when the Universe began, science has found it much harder to answer the question about how it began. In recent years, however, there have been several ideas about how this could have been. Rather than crediting God with an act of creation, physicists have conceived other processes which could produce universes like ours. In fact, one of these processes is almost capable of taking place in a laboratory using a total mass of only about 10 kg (Guth, 1991 and references therein). Another possibility lies in so-called quantum fluctuations in which particles emerge spontaneously and temporarily from a vacuum (Tryon, 1973).

These are just two examples of how modern theoretical physics attempts to find answers to the question of what the Universe really is, and how it was formed. One might ask whether the veil on creation is now likely to be lifted soon. Before one answers in the affirmative, it should be remembered that we are dealing with phenomena at the very edge of our knowledge of physical theory and that, therefore, the uncertainties about the validity of the assumptions are at least as large as in the case of creation of all matter by God in a miraculous way, *i.e.* outside the known laws of physics. And, even if some of the proposed mechanisms are capable of some degree of verification through their predictions about present conditions, it will most likely still be impossible to give definitive, unambiguous answers to the question about how the Universe began.

Premonitions about this impossibility are probably among the main reasons why some have tried to avoid answering the above question at all. Instead, they have postulated that the expansion of the Universe will ultimately come to a halt and that thereafter it will collapse again. After it has contracted to sufficiently high temperatures and pressures, the conditions would be ideal for a new explosion or a bounce. This process would have repeated itself many times and such an 'oscillating universe' could have existed from much earlier times than almost any other universe.

While our present experience suggests that entropy can only increase and that with every next generation such a universe would slowly degrade, it is also conceivable that in the new physics after a bounce entropy is largely or completely eliminated. If, in addition, in such a universe some fresh matter could be created with every bounce (maybe through vacuum fluctuations), then, after a sufficient number of cycles it would accumulate enough matter to allow the development of life. And, because of the increased energy content in every new cycle, each cycle would last longer than the previous one (Dicke and Peebles, 1979).

Whatever the length of time a hypothetical universe can exist, the oscillating universe is not a really satisfactory answer to the question about the origin of the Universe. For one thing, it is not (yet?) a scientific answer because it postulates unverifiable conditions. And for the creationist it is no answer at all. For, while God's universal creation could have existed for a very long time, to have it go through a series of creation-like events and subsequent apocalyptic destructions, seems to be contrary to all we seem to know about the Creator, despite the 'precedent' of the worldwide Noachian flood. Also, for those who believe in the faithfulness of the Genesis account about the origin of all things, there is no need for a long history of the Universe or the presence of a sufficiently high number of particles in it in order to facilitate the process of biological evolution.

Exactly how and when the Universe came into being is, I believe, a matter which cannot be settled by science alone. Even with the best possible physical theories, there will always a problem about the very first beginnings or, at least, about our, unverifiable, assumptions about the conditions prevailing at the very earliest epochs. I find it, therefore, appropriate to remind ourselves of the words spoken by Judge Overton at the 1981/82 Arkansas Creation Trial:

> 'Creation out of nothing' is a concept unique to Western religions. In traditional Western religious thought, the conception of a creator of the world 'out of nothing' is the ultimate religious statement because God is the only actor ... The only one who has this power is God ... The idea of sudden creation from nothing, or creatio ex nihilo , is an inherently religious concept.'

It seems as if scientific cosmologists are coming awfully close to practising religious thinking when they speak about virtual quantum fluctuations, charge-parity symmetry violation and, maybe, singularities as a way of starting the Universe! So, why not admit that God is the Creator? After that we can use the Bible to find out why He created, and science to reveal His methods.

The human factor

In the last section we moved away from the purely physical to the more philosophical. So let us now consider another philosophical reason for considering alternatives to the Standard Model, the so-called 'human factor.'

Whereas the first few minutes of the Big Bang saw the production of the very lightest chemical elements only, men and animals contain a large proportion of heavier elements. In the Standard Model, these were generated in the nuclear ovens deep inside stars. Towards the final phases of a star's existence as a luminous body, when its central temperature is increasing to ever higher values, the processes of nucleogenesis generate the heavier elements. After the star's final break-up these are delivered to interstellar space, ready for incorporation into a next generation of stars and planets. Somehow, somewhere, the conditions for the synthesis of more complex molecules, amino-acids, and other essential elements of life would have been fulfilled and the long journey of evolution got under way to lead, ultimately, to man.

While this scenario seems to offer some harmony with the biblical statement in the case of our formation from the 'dust of the ground,' it does not explain how we came to possess the 'image of God' and it reduces the Genesis account to mere mythology. While this article is concerned with the physical aspects of the Universe and the Standard Model, since the latter sees man as a clever combination of physical, chemical, biological and other processes, it must be pointed out that such human characteristics as love, hate, beauty, sorrow, happiness, etc., in addition to explaining why the Universe and we are here, need to be addressed as well. Does the Standard Model do this? No. All it offers is some explanation of how we came to be here—through the extremely improbable and therefore rather accidental synthesis of a number of amino-acids.

Those who want an answer to the deeper question why we are here would be much better advised to consult the Word of God than the latest embellishments of the Big Bang theory. It is fair to say that here is a prime example of how the neglect of non-science by scientists has impoverished cosmology resulting in a lack of direction, and much senselessness and fatalism.

This whole matter has been expressed clearly by Weinberg, a leading physicist, in his book *The First Three Minutes* in which he presents today's model of the beginning of the Universe and then concludes (Weinberg, 1978):

> 'It is a fact that man cannot get away from the idea that he has a special relation to the Universe and that human life is more than the rather absurd result of a whole chain of chance incidents which goes back to the first three minutes [of the Universe], but rather that, in one way or other, we have been planned and built into the Universe .... It is even more difficult to think that this Universe, as we know it today, was developed from an initial situation which defies our wildest imagination, only to meet a future end in insupportable heat or unbearable cold. It seems as if, the more we begin to understand the Universe, the less it seems to make sense. But although there may be no comfort in the results of our investigations, the very process of investigation gives us some consolation..... The self-imposed effort to obtain insight in the structure of the Universe is one of those very few activities which lift human life a little bit above the level of a senseless joke.'

Another reason for considering philosophical alternatives to the Standard Model lies in the fact that its adherents reject various possible alternatives on the ground that they would be philosophically unattractive or unsatisfactory. Hubble's above-quoted conclusion about the redshifts and the expanding Universe is an example. Let us not forget, however, that scientists do have their own philosophical presuppositions. One of these would be their belief that everything must be explained through natural laws, maybe even typically non-physical, phenomena like love, hate, beauty, life. In this process there is no longer a need to include God in the picture. As Dyson once said, cosmology has deteriorated to the level of 'cosmolatry.'

The divine alternative

NASA astronomer Jastrow, after discussing the as yet inconclusive results of our investigations into the origin of the Universe, writes,

> 'Now we would like to pursue that inquiry farther back in time, but the barrier to further progress seems insurmountable. It is not a matter of another year, another decade of work, another measurement, or another theory; at this moment it seems as though science will never be able to raise the curtain on the mystery of creation. For the scientist who has lived by his faith in the power of reason, the story ends like a bad dream. He has scaled the mountains of ignorance; he is about to conquer the highest peak; as he pulls himself over the final rock, he is greeted by a band of theologians who have been sitting there for centuries.' (Jastrow, 1978)

I would think the theologians of the above quotation have been enjoying the panorama their high position affords. Their presence reminds us, too, of the possibility to consider alternative scenarios for the origin and structure of the Universe that go beyond the purely physical into the metaphysical and/or religious fields. We feel even more justified to do so because our discussion of the Standard Model has turned up a number of reasons why the search for alternatives must continue. There are the instances of fine-tuning which become all the more remarkable once one admits that the *a posteriori* explanation given through the Anthropic Principle may be an act of evading the real issue: To what extent must God be brought into the scenario to make it a viable one?

The role God would have played in the origin of the Universe is seen different by different people. Some say that because they don't know about the very beginning of things, nor about what went before or how life itself originated, we should believe in a god. This is the position of deistic evolution which I consider a negative view. As soon as science finds an explanation for what is still a puzzle today, such a god is no longer required. It is one of the reasons why even in many so-called Christian churches today, God has slowly but surely been pushed back further into the wings.

A more positive view is to believe in creation by God as it is described in the Bible. People who believe in God in this way never do this because of any shortcomings of scientific theories, but because they have a personal relationship with God which has taught them that His Word is thoroughly reliable. It is also positive in that this view includes some understanding of good and evil, the purpose of life, and other non-physical questions which science cannot address. People with this view are open to some so-called unscientific alternatives, which have already been rejected by the 'pure' scientists, because they realize that there is more to the Universe than meets the eye. As Einstein once expressed it: '*Science without religion is lame, religion without science is blind*' (Frank, 1947). Those who take the above view do not see God in competition with science as a means of explaining life and the Universe, but as the Creator of the Universe with all that it contains, including life.

Finally, it is interesting to reflect for a moment upon the time before there was a Universe at all. In our physical theories there is no 'before,' *i.e.* the Universe must have originated spontaneously. The Bible tells us that before the 'beginning' of Genesis 1 there was God. This has led some to ask what it was that God was doing before He created the Universe. It is said the 5th century sage St. Augustine had an answer to this question: 'Before He created Heaven and Earth, God created hell to be used for people such as you who ask this kind of question' (Oliver, 1988).

The sum of the matter

We are now in a position to give some answer to the questions posed in the Introduction. The current scientific picture of the origin and structure of the Universe, the Standard Hot Big Bang model, is not altogether in conflict with the Genesis account. Those who acknowledge the lack of scientific definition in Genesis will find much room to accommodate many aspects of the Standard Model. Its great age of 15 billion years could be the correct value if one limits this age to the inanimate, physical Universe. However, even if one is prepared to accept a high age for the physical Universe, its exact age is still open to considerable doubt.

However, there are weaknesses in the Standard Model. First, the interpretation of the observed redshifts as the general expansion of the Universe is based on philosophical arguments and takes one beyond the normal confines of physical science. Second, another cornerstone of the Standard Model, the Cosmological Principle, is also a purely philosophical assumption and, in fact, may not be true at all. Third, while it seems that the recently-discovered anisotropy in the MBR means solid support for the Standard Model in that it allows the formation of its present-day large-scale structure, the inflationary phase in the very early Universe requires some very speculative physics to avoid producing a Universe without such anisotropies.

While the above are somewhat negative arguments for considering alternatives to the Standard Model, there are a number of remarkable coincidences in the Universe which point to an intelligent design. Among these we count the flatness of the Universe. The fine tuning this requires was delivered by the realization that an inflationary phase could explain this. However, the inflationary model needs some finely-tuned physical conditions to be met for its own success. Neither is this problem solved by the adoption of the Anthropic Principle. This is, again, an instance of the introduction of deeply philosophical arguments into what is meant to be a purely physical theory.

Another coincidence is found in the small asymmetry between matter and antimatter. While science is not lacking in theories to explain this, they are based on almost unverifiable assumptions because the physical conditions at the beginning of the Universe were so remote from what we are able to simulate in our laboratories. These same conditions also prevent us from penetrating the earliest moments of the Universe and theorize successfully about how it actually came into existence. The possible occurrence of a singularity at the beginning of the Universe, too, leaves room for considering non-physical alternatives.

The Standard Model does conflict with Genesis, however, on the origin and purpose of life and its characteristics. In the Standard Model there is supposed to be enough time for biological evolution to take its assumed course, while Genesis states quite categorically that all life is created by God.

Thus, in the end we come back to God as the only One who can answer our questions because He is the Creator of everything and gave it beauty and purpose so that we might enjoy it and find answers, not only to our physical queries, but indeed, to all our questions.

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Notes:

1. Peebles *et al.* (1991) and Peebles and Silk (1990) give more information on the Standard Model and its merits, respectively; an alternative view is presented by Arp et al. (1990) and an evaluation of various theories for the origin of the Universe's large-scale structure is given by Kashlinsky and Jones (1991).
2. A comprehensive discussion of the various forms of the Anthropic Principle, from the evolutionist point of view, is found in the book *The Anthropic Cosmological Principle* by J. D. Barrow and F. J. Tipler, Oxford University Press, 1986.

[Continued on Page 23]

The Starfish Bed of Dorset:

A Post-Flood Catastrophe?

Paul Garner

THE county of Dorset has long been famous for its geology, especially its remarkable fossil fauna, with the stretch of coastline around the towns of Lyme Regis and Charmouth attracting particular attention. It was at Lyme Regis that eleven year old Mary Anning discovered the first complete ichthyosaur specimen in 1811.

The cliffs here consist largely of Lower Jurassic (Lias) strata dipping gently to the south, although on the higher cliffs middle Cretaceous (Albian) rocks crop out. A good account of the geology of the Dorset coast is provided by House (1989).

David Tyler and Joachim Scheven (1988) have argued that similar Lower Jurassic rocks exposed along the Yorkshire coast at Robin Hood's Bay, Ravenscar and Staithes date from the years following the Flood, rather than from the Flood event itself. They propose that these Liassic strata represent a post-Flood mega-succession, deposited in transitory epicontinental seas. This preliminary model seems to be equally applicable to the Dorset Lias.

The higher beds of the Lias are best exposed a little further east along the Dorset coast near Seatown. The Middle Liassic Eype Clay, a series of micaceous blue and grey marls, crops out low in Ridge Cliff, east of Seatown, with one horizon—the Eype Nodule Bed—containing occasional nodules bearing the ammonite *Amaltheus stokesi*. Some 16 metres above the Nodule Bed, at the junction between the Eype Clay and the Down Cliff Sands, lies a 1 metre thick band known as the Starfish Bed. This stratum has been traced as a persistent horizon over 70 square kilometres, and is one of the few horizons in the British Mesozoic where ophiuroids (brittle stars) are relatively common, albeit limited to two species (Goldring and Stephenson 1972).

Preservational Circumstances

Examination of the Starfish Bed has led investigators to some interesting conclusions regarding the circumstances under which the brittlestars were preserved. According to Goldring and Stephenson (p.612) the Starfish Bed '... represents an episode of relatively rapid sedimentation which buried and, in part, smothered the ophiuroids.' The authors employ the term obrution, from the Latin *obruo* 'to cover,' to describe the process by which the creatures were overwhelmed.

Although brittlestars, starfish, and other echinoderms are not common fossils, when they are found it is usually in abundance. Paul (1979, p.453) writes: 'Starfish, for example, are relatively rare as fossils, yet at several horizons their remains are sufficiently common for the enclosing sediments to be called 'starfish beds.' This well-known phenomenon is by no means confined to asterozoans and is, I believe, fairly typical of the fossil record of more or less complete echinoderms.'

It is noteworthy that echinoderm skeletons tend to dissociate within a few days of death, so rapid burial is an essential prerequisite for whole, or even partial, skeletal material to be preserved. The skeletal parts of brittlestars are joined only by skin or connective tissue and easily become detached and scattered after death (Schafer 1972, p.97). Goldring and Stephenson (p.622) conclude that the essential condition for good preservation of all echinoderm skeletons is rapid burial without subsequent reworking of the sediment, hydraulic or biomechanical.

Another interesting feature of ancient brittlestar beds is the lack of injuries in the preserved populations. Aronson (1987) found that not one brittle star in an unspecified population from the Jurassic of Dorset was regenerating an arm, whereas 70 per cent of a closely related living species from Belize had at least one injured arm. He points out that other workers have studied injuries in several additional pre-Cretaceous ophiuroid communities and the highest level of injury found was 2 per cent. Aronson attributed this big difference to an increase in predation since the Jurassic due to the appearance of newly evolved, more efficient predators. For those individuals who seek to harmonise the geological data with the biblical record this evolutionary interpretation is not appropriate. If Tyler and Scheven are correct to assign the Jurassic an early post-Flood age, then the lack of predation evident in ancient brittle stars could be an indication of an unbalanced ecosystem. The years post-dating the Flood would have been times of great instability in ecological terms, and there would almost certainly have been episodes of residual catastrophism. Palæoecological data appear to support an early post-Flood model for the Mesozoic strata.

Conclusion

Formations such as the Middle Lias Starfish Bed of Dorset provide clear evidence for unusual catastrophic burial events in the earth's geologic past. This evidence is consistent with creationist models of earth history which recognize the important role of the biblical Flood and its aftermath in shaping the surface of our planet.

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News of Creation

Evolution: is it Credible?

Paul Garner

PROFESSOR TERRY HAMBLIN was the speaker at a meeting entitled 'Evolution: is it credible?' held at St Bartholomew's Hospital, London on Monday 5 October 1992. Ably organized by Nicholas Herodotou, a Clinical Medical Student, the meeting began at 7pm in the magnificent Great Hall of the Hospital, and was well attended.

Professor Hamblin is an immunohæmatologist with over 270 published scientific papers to his credit, and is an editor of the journals 'Leukæmia Research' and 'Transfusion Science.' He is also a vice-president of the Biblical Creation Society.

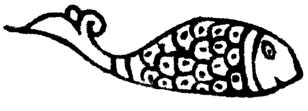
The speaker began his lecture by reminding his audience that science is all about proposing hypotheses and then attempting to falsify them. Using this as his launching pad Professor Hamblin critically examined the evolutionary hypothesis, covering a number of diverse subjects of basic importance to the creation-evolution controversy.

This critique left evolution plainly wanting. The micro-evolutionary processes observed in nature are not sufficiently powerful to drive inorganic matter to man. Several points were highlighted about Stanley Miller's famous experiments which detract from the notion, entrenched in the popular consciousness, that life has been created in the laboratory.

Other topics briefly discussed included thermodynamics, embryological recapitulation, punctuated equilibrium, and the problem of scientific error and fraud. The fossil record was covered in more detail, with particular emphasis on the unbridged gaps, and those creatures usually publicised as 'missing links'—such as *Archæopteryx* and the horse series.

Having discussed the improbabilities of evolutionary theory, Professor Hamblin anticipated the counter-argument that creation in six days is equally improbable. Here, the speaker declared his prejudice towards creation, for the reason that he had found the rest of Scripture trustworthy. A short question time then followed, with queries about mutations, the timescale of creation, and the Big Bang.

Despite being interrupted in the middle by a fire alarm, at which juncture everyone present had to stand outside for about 15 minutes, the lecture was generally well received. In all, well over 100 people attended, the majority of whom were Christians. Brian Austin from the Mustard Seed provided a good range of creationist books for sale, and BCS literature was also available, including back issues of *Origins.*



Rocks and Scripture: The Millions of Years Time-Scale

and some Geological Common Sense

Michael Garton

A WIDE variety of methods are now available to date rocks, all suggesting that the earth is millions of years old. Without entering into the technical arguments, do the results make for geological common sense?

Introduction

Before the middle of the last century, engineers, naturalists and geologists had established that various rock types extend across Europe and beyond. They were also able to demonstrate that rock layers build up progressively, one on top of another. Various estimates were made about how long particular layers, or whole sequences, took to form. It was not until the turn of the century—and the discovery of radioactivity—that it seemed to become possible to date rocks more precisely.

Referred to as 'absolute dating,' all such dating methods generate enormous ages, supporting the view that the earth is thousands of millions of years old. Taking the radioactive decay data in isolation, this is certainly a reasonable conclusion (Morton, 1982), provided (and the proviso is a big one) that the theoretical basis common to all radiometric methods is sound.

Rather than attempt a technical evaluation of dating theory, we shall follow the advice of the old adage, 'The proof of the pudding lies in the eating.' If the radiometric dates are valid, then they should be supported by a wealth of other evidence, verifying their theoretical basis and confirming that rock layers formed over vast æons.

Milton (1992, p. 55) reviewed some alternative evidence suggesting the earth may in fact be much younger—less than 175,000 years, and perhaps even less than 9,000 years. In this article we will compare and contrast the millions of years time-scale with the creationist view, which agrees with the shortest of Milton's estimates. Most creationists suggest that the earth is under 10,000 years old.

Two undertakings lie ahead of us. We need to work out how fast rocks must form to satisfy the contrasting timetables. Then we need to consider what evidence might be available in cliffs, road cuttings and quarries to assess whether either scheme accords with earth history.

One Year—or Two Hundred and Sixty Million

In England and Wales the rock layers which have been dated most extensively are those which appear at the surface. These are the fossiliferous layers, which yield radiometric ages up to 550 million years. They correspond to what a geologist would term the Cambrian to Recent strata. They are up to 38 kilometres thick (computed from Duff and Smith, 1992). The earth's crust is generally thinner than 38 kilometres, showing that this figure has been compiled from different areas of England and Wales, wherever there is a maximum thickness for a particular time interval. For example, in the radiometric interval dated 500–550 million years, the maximum thickness is found in North Wales, whilst for the next succeeding interval the maximum is found in the Lake District etc.

Our task of discriminating between two conflicting models will be made easiest if we evaluate them where they predict the most disparate conclusions. We shall therefore consider the radiometric interval between 550–290 million years: on the creationist scheme outlined earlier (Garton, 1990) this 260 million year interval should actually equal a single year!

The rock layers we shall focus on (in the Cambrian to Carboniferous interval) can be examined west of a line from Newcastle upon Tyne to Exeter. They make up all of Cornwall, Wales and the Lake District. Beginning with the earliest fossils of the Cambrian, they extend up to the top of the coal measures, with a maximum thickness of 30 kilometres.

We have:

	Radiometric age Determination	Creationist model
Carboniferous to Cambrian	260,000,000 years	1 year

Four Metres per Hour or a Hair's Breadth in a Year?

Depositing a 30 kilometre sequence in less than a year raises two questions. Can sediments accumulate that fast? Where did all the material come from? The first question is central to this article, the second needs fuller treatment than I can give it here.

If a worldwide Flood occurred, expressing God's judgement, then it would have been a cataclysmic event with tremendous erosive power. Moreover, if Cambrian to Carboniferous strata correspond to the Flood, geology suggests that sedimentation was not continuous in any location throughout the whole period. From the rock record we can infer that there were always large areas exposed to tremendous attrition. Material from vast source regions was concentrated in certain areas, and this is reflected in the inflated thicknesses of the composite sections. If you live, or have experienced a wet holiday, on the west coast of Britain, you may appreciate a climatic analogy. It may rain continuously for weeks on the west coast—because all over the tropics the hot sun is evaporating water from the oceans and replenishing the clouds. The rain—like ancient sediment—is concentrated in certain areas at certain times.

Returning to the central question about rates of deposition, we must determine whether 30,000 metres has time to pile up in less than a year (the Genesis account implies that the waters were on the earth for 314 days).

We have:

$$\frac{30{,}000}{314} \quad \text{metres per day}$$

$$= 95.5 \quad \text{metres per day}$$

which is more comprehendible expressed as 4 metres per hour, a maximum average rate which was not continuous in any one place for the whole period.

To understand what these figures mean, consider some familiar objects. A typical two storey house is about nine metres high. Assuming that the house had not been washed away, then our calculation suggests that during the Flood, it would have taken about two and a quarter hours to bury it. You are probably reading this magazine in a room of average ceiling height—about 3 metres or 10 feet. At this rate of Flood sedimentation your room would have been buried up to the ceiling in 45 minutes. The magazine you are holding is about 30 cm high. Stood up on end, Flood sediments would have taken four and a half minutes to bury it.

If the Flood was a tumultuous event then these rates are conceivable for short periods. In the alternative model, if the radiometric dates are correct then a one year episode must be replaced with 260 million years. In order to appreciate what this means in reality we shall again calculate the average rate of sedimentation. With 30,000 kilometres of rock we have:

$$\frac{30{,}000}{260{,}000{,}000} \quad \text{metres per year}$$

$$= 0.00011 \quad \text{metres per year}$$

which is probably better expressed as 1/10th of a millimetre (0.11 millimetres) per year. Milton (1992, p. 23) calculated a similar value (1/5th millimetre per year) using the maximum world wide thicknesses of sediment (rather than our calculations based on Great Britain). It might be argued that these rates are artificially slow, because much more sediment was originally deposited but was eroded away. However, we have deliberately sought out the thickest sections which appear to have escaped erosion and where no component is known to be missing. A rate of about 1/5th of a millimetre per year (and frequently much slower) is often quoted in literature (*e.g.* Alego and Wilkinson, 1988; House, 1989, p. 4) showing that such slow rates are accepted by the geological community.

Richard Milton suggests that it is worth noticing that sediment accumulating at 1/5th millimetre (about a hair's breadth) in a year, 'would be quite incapable of burying and fossilising entire forests, dinosaurs or even a medium size tadpole.' (Milton 1992, p. 23).

Professor Ager has noted that even one sand grain falling on a square metre of the sea bed each year, 'would give us vastly more sediment than we normally seem to find preserved ...' (Ager, 1993, p. 42). Ager accepted radiometric dates, and had to explain the obvious fact that many individual strata formed quickly (and did fossilise dinosaurs, trees and tadpoles). Evidence such as rapid dumping of sand from the passage of short-lived currents, animals buried alive or simply the presence of fossils all testify to rapid burial. In using radiometric dates, '...we are always faced with a contradiction between rates of deposition and the known thickness of rock for a particular period of geological time.' (Ager, 1993, p. 44).

If the millions of years time-scale is correct then Ager (1993, p. 52) is surely right to assert, 'But I maintain that a far more accurate picture of the stratigraphical record is of one long gap with only very occasional sedimentation.' The only reason long time gaps are inferred between layers is because radiometric dates demand them.

Keeping within a Hair's Breadth

The fastest average rate of accumulation for the British Cambrian to Carboniferous was calculated above at 0.11 millimetres per year. Suppose a current on the sea bed distributed a layer just one sand grain thick. A grain of sand is over five times thicker than the annual average rate of deposition. Hence the momentary action of a passing current would have greatly exceeded the annual sediment budget. On the average, there would have to be a cessation of further activity for the next five years.

The majority of rock layers are much thicker than a single grain of sand. Layers in excess of one metre are

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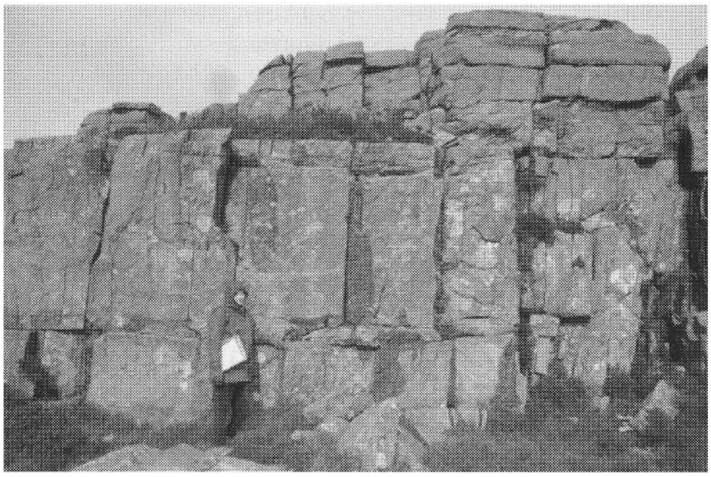


Figure 1—A thick sandstone bed which probably accumulated from one pulse of current, and certainly very quickly. If radiometric dating gives correct values and time is evenly distributed throughout this sequence of sandstone then the junction between layers would have to represent thousands of years.
On the creationist model, this layer would be an early Flood deposit. The bedding planes would represent less than half an hour. Rhinog Grit, Lower Cambrian, Harlech, North Wales.

common. Each bed two metres in thickness (Figure 1) is equivalent to 18,000 years of sedimentation if the annual average is 0.11 mm/year. Hence the existence of this layer would necessitate a compensatory pause in sedimentation amounting to 18,000 years if radiometric dating is correct. It could be represented at the junction between the layers, or in some other part of the section. According to the creationist alternative, at 4 metres/hour the bedding plane might represent about half an hour.

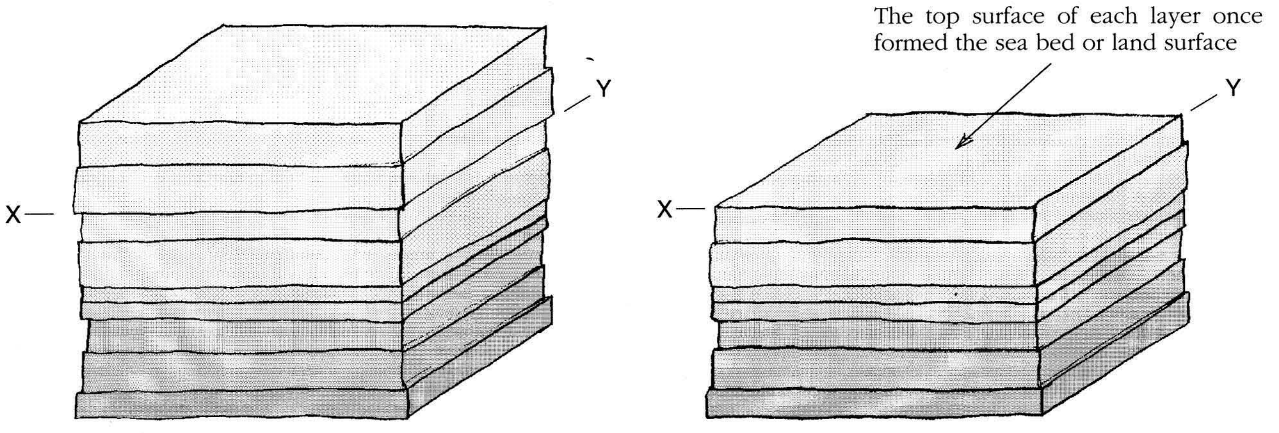
The millions of years time-scale can only be convincing if the stratigraphical record is one of long gaps and only very occasional sedimentation. Creationist models are only valid if sedimentation is more or less continuous (particularly in the Flood interval). What criteria could we use to test which view is correct?

The Problem of Age

Is there any way of estimating how much time could be represented between the deposition of each layer (or how long each layer may have taken to form)? These tasks are by no means hopeless. A few moments thought will show that the length of these intervals is subject to considerable constraint. For it must be remembered that the top of any layer of sedimentary rock must once have been at the top of the sea bed or land (Figure 2).

Suppose a sequence of marine strata had just reached level X—Y of Figure 2. The top layer X—Y is likely to consist of wet sediments, and typically will extend as a flat surface for considerable distance, sometimes for hundreds or thousands of square miles (thereby emphasising the divorce from any modern analogue). It is easy to see that such a layer is extremely vulnerable to damage.

On the floor of the North Sea there exist a wide range of features which render the sea floor far from smooth. The surface sediment is in motion, responding to tidal movement and storms (Smith, 1992, p. 471). If a layer were deposited on the floor of the North Sea then within 12 hours the next tide will begin scouring and eroding it away. Within a few weeks, the top will quickly become channelled and parts of the layer will have been removed altogether. The layer certainly could not survive in perfect condition for centuries. On land any extensive, newly deposited sediment is even more likely to suffer disruption, being at the mercy of the next heavy rain. Then there are biological considerations. In shallow seas all manner of animals will walk over the deposit and dig into it (clams, crabs, shrimps, worms etc). If similar animals



The top surface of each layer once formed the sea bed or land surface
X
Y
X
Y

Figure 2—Former sea bottoms or land surfaces. The layers in a cliff face, such as the one on the left, have been deposited one on top of another. Consequently there must have been a time when the top of any layer (such as X—Y) formed the top of the sea bed or land before the next blanket of sediment covered it.

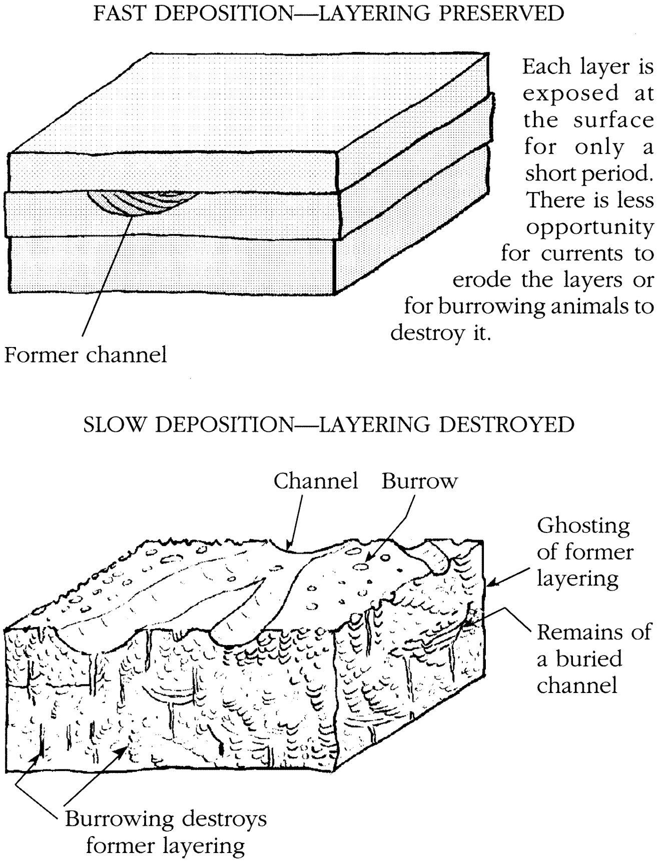

FAST DEPOSITION—LAYERING PRESERVED
Each layer is exposed at the surface for only a short period. There is less opportunity for currents to erode the layers or for burrowing animals to destroy it.
Former channel
SLOW DEPOSITION—LAYERING DESTROYED
Channel
Burrow
Ghosting of former layering
Remains of a buried channel
Burrowing destroys former layering

Figure 3—Three hypothetical layers, showing how rapid accumulation favours the preservation of layering whilst slow rates give time for the layers to be eroded and disrupted by animal burrows etc.

existed in any abundance (and much of the fossil record suggests they were abundant in more remote times) such animals would have quickly invaded the new layer and left their mark.

We could make some predictions about the appearance of two rock sequences, one laid down extremely rapidly, the other very slowly (Figure 3). Slow accumulation results in strong layer disruption. Stratification is no longer continuous because time is available for it to be become disordered from within (by animals burrowing etc) and eroded by currents from without. Let us suppose that the layers were separated by 100 year intervals. Other than in the deep sea sediments, it is difficult to think of an environment today where such a sequence could escape the disruption shown in Figure 3. Conversely, a similar sequence of sedimentary rocks which accumulated in the space of a few minutes or hours would stand the best chance of being preserved intact.

We can apply these simple criteria to the two metre thick beds at Harlech, North Wales (Figure 1). The junction between the layers does not show any sign of disruption (although there are what are called loading structures implying rapid dumping of wet sediment). It really does seem most unlikely that any amount of time can be represented by the junction between layers, and certainly not anything like the 18,000 years our calculations implied. If the radiometric ages are valid, then the time must be accounted for elsewhere.

Unfortunately, this solution raises problems. For in referring to these rocks around Harlech, Cowie (1992, p. 41) observes, 'A remarkable feature of this succession is that the 3,000 m or more of strata give no evidence of unconformities or stratigraphical breaks of importance.' If our average rate of sedimentation is correct then these rocks represent around:

$$\frac{3{,}000}{0.00011} \quad \text{years}$$

$$= 27{,}000{,}000 \quad \text{years}$$

Presumably these vast periods would have to be accounted for within the finer grained members of the sequence, despite Cowie's observation.

The creationist model suggested a half hour break between the thicker beds. However, the rocks illustrated in Figure 1 bear all the hallmarks of extremely rapid deposition, suggesting that one layer may have followed another even more quickly than this.

Hiding your age

Now let us examine a cliff face. The east face of Mam Tor, Derbyshire, displays a tremendous section through Carboniferous strata (Figure 4). The familiar coal measures must have formed after these layers for they lie above. In this cliff, the layers are made up of units, between 0.9m and 2.4m thick (Cripps and Hird, 1992), and again the top of each must once have formed the bottom of the sea before it was buried by the one above. Using the published ages, and measuring the local thicknesses in this region, we find the average rate of sedimentation agrees with the nationwide average we have been using, working out at at 0.0001 metres per year (Kelling and Collinson, 1992, p.241 with Eager and Dunning, 1992). The whole cliff is about 100 metres high.

We shall consider each bedding unit to be one metre thick (although many units are much thicker). The total number of metre units in this 100 metre cliff is therefore 100. If radiometric time is evenly distributed then the cliff took about one million years to build up. Each layer would then represent:

$$\frac{1{,}000{,}000}{100} \quad \text{years}$$

$$= 10{,}000 \quad \text{years.}$$

As is well understood, these units are the sedimentary carpets left behind from fast moving, sediment-laden currents ('turbidity currents'). Unquestionably, each layer formed fast (Allen, 1960). Therefore the 10,000 years we might try to allocate to each layer cannot be accounted for by slow accumulation within the layer: the long periods

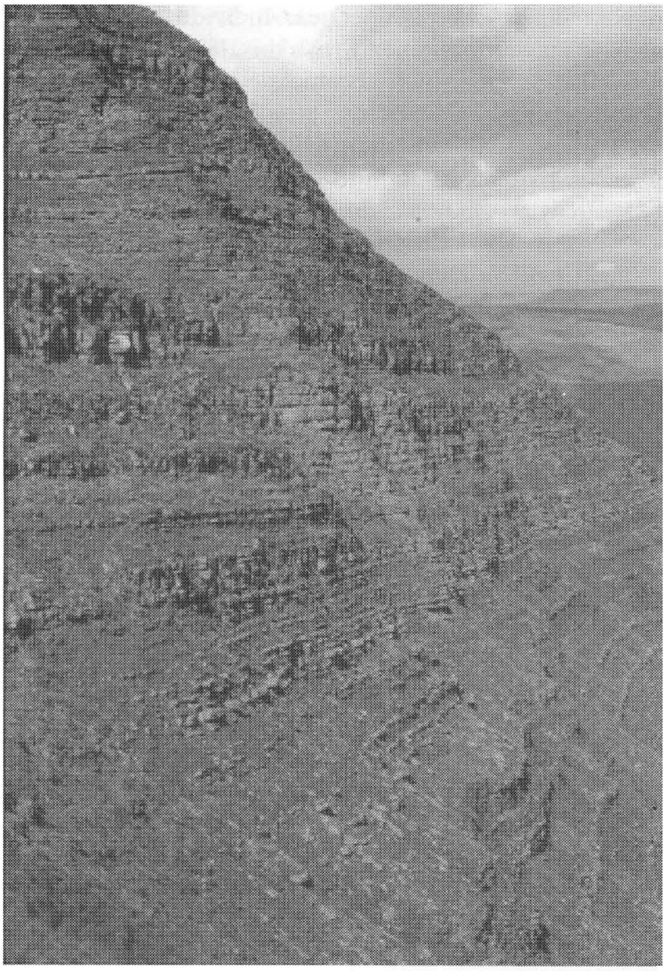


Figure 4—The East Face of Mam Tor, Derbyshire. According to the radiometric time-scale, this cliff would be expected to represent about one million years, even though evidence from each layer within it suggests rapid deposition. It is next to impossible to accommodate such vast time periods into a model for the genesis of these layers. From the calculations in the text the alternate explanation is 33 hours of rapid sedimentation, late in the Flood year.

would have to be squeezed into the intervals between the influxes of material.

Primary layering is beautifully preserved at Mam Tor, even down to the most delicate structures. No layer of this cliff face has stood as the sea bottom for any length of time at all. One constant discovery are the loading marks on the bottom of sand layers, bearing testimony to how rapidly the turbidity currents swept in and dumped their next consignment.

So let us now explore a Flood explanation for the strata. If the overlaying coal measures mark the end of the Flood (Garton, 1990) then the Mam Tor sequence was late in the Flood year. From the biblical account it is clear that the Flood was most powerful in the early stages, and waned later. In view of this, we shall drop the rate of Flood sedimentation from 4 m to 3 m per hour. Thus the whole cliff, being 100 metres thick, would have built up in about 33 hours, or 2,000 minutes. Since there are 100 layers, we have:

$$\frac{2,000}{100} \quad \text{minutes per unit}$$

$$= 20 \quad \text{minutes for each layering event}$$

This calculation suggests that the turbidity currents would have swept in about one every twenty minutes. Here is the explanation of many features: why the layers are in such perfect condition; why there is a lack of layer disruption by animal burrowing; why fossils are found only on odd, discrete planes and not distributed throughout; why the fossils are crushed (because of rapid burial); why the layers are so similar (the source of supply and the means of delivery did not have to remain constant for enormous periods). Every aspect of the record indicates an environment of very rapid deposition and sudden changes.

The 'extremely rapid sandstone deposition' is recognised by Swan (1992, p. 76), who is unable to give an environmental explanation for the unfossiliferous siltstone. He suggests that most of the (radiometric) time must be accounted for in certain richly fossiliferous marine muds which were deposited very slowly. Thin sequences of mud would have to represent several million years. If the mud settled so slowly it is hard to understand how the shells that settled with it could ever have been fossilised. Another major difficulty is the lack of animals living on the sea bottom: if the muds did accumulate over vast periods, there would have been ample time for animals to walk or swim in and establish a normal community; yet they are not found. The laminations in the sediment also show no signs of disturbance through burrowing. There are plenty of nutrients and the bottom waters were oxygenated (Holdsworth, 1966). Could it be that in reality the muds also built up fast, so fast that colonisation was impossible?

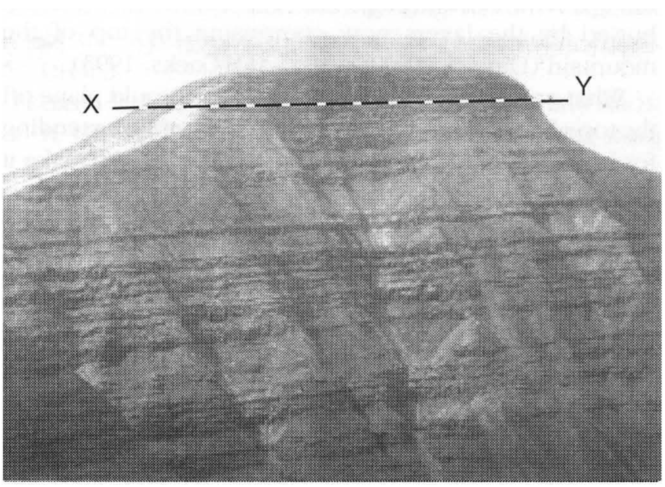


Figure 5—The north face of Pen y Fan, Brecon Beacons, South Wales. There is a difference between the rock layers above and below X—Y, undoubtedly reflecting a pause in sedimentation. Creationists postulate a duration measured in days, but the evolutionary time-scale demands an interval of over 10 million years.

Fish to Amphibian Evolution—Quicker than you imagined?

If radiometric dating can be called into question, then Darwinian evolution theory is challenged as well. Let us consider a key evolutionary step—the evolution of fish into amphibians. The absence of fossils supporting this transition is dramatically obvious and is the reason why there is no general agreement as to which fish evolved into what amphibian. The earliest known amphibians were fully developed amphibians (Denton, 1985, p. 166–7). Nevertheless, there is still widespread acceptance that fish evolved into amphibia by the 'Late Devonian,' a little over 350 million radiometric years ago (Brown, 1988, p. 449; Eager and Dunning, 1992).

The crucial developments in this alleged transition must have been occurring when the rocks now found in the Brecon Beacons, South Wales were forming (Lovell, 1978; Dineley, 1992, p.185). Subsequent earth movements have elevated the rocks (Figure 5). In the absence of a demonstrable evolutionary sequence from fish to amphibia, what we *can* consider is how much time the rocks in Figure 5 represent—for the time interval they represent is the amount of time available for the transition.

According to the evolutionary scheme, when the lowest layers were deposited, amphibians had not yet evolved whereas the uppermost layers correlate with rocks where they had. The critical section is at X—Y. The radiometric scale indicates that the layer immediately above X—Y is over 10 million years younger than the layers immediately below.

In other words, the junction between the layers at X—Y must represent an astronomical amount of time, important for evolutionary development.

The rocks below X—Y are generally understood to have been a land surface, exposed to erosion, before being buried by the layers now comprising the top of the mountain (Dineley, 1992, p.186, 200; Cocks, 1993).

What process of erosion is there, which could plane off the top of the lower sequence at X—Y, a surface extending for hundreds of square miles, in such a way as to make it appear that such a vast interval of time did not exist? (It is a fact that geologists did overlook what is now claimed to be missing æons, as the discussion in Allen (1964) makes clear).

On the other hand, if the surface at X—Y represents an interval of at most a few weeks, this smooth plane could have resulted from several powerful waves traversing the wet sediments. The surface could only have been preserved so perfectly if it was immediately blanketed with the overlaying sediment.

Conclusions

Radiometric dating generates a millions of years time-scale. This in turn implies that sedimentary rocks must have formed very slowly—building up at an average rate of about a hair's breadth per year. Individual strata clearly formed much more quickly than this. If radiometric dates are valid, layers which accumulated rapidly must have been compensated for by long periods when no deposition took place. Otherwise the average rate of deposition would be violated. During these pauses or gaps, newly formed layers ought to have lain around, exposed to the elements and biological disruption for thousands of years.

Field evidence contradicts such a conclusion. In the sections we have examined (with radiometric dates between 550–290 million years) not only have individual layers formed quickly, but the next succeeding layer has been added quickly too, suggesting that whole cliff faces represent short time intervals. In consequence, if radiometric dates are real, larger and larger amounts of time must be accounted for in fewer and fewer layers.

It is difficult enough explaining why the time lies unrepresented if it is distributed evenly throughout a section. The problem is exasperated when even larger periods of time are focused into fewer layers. I suggest that this is a burden the geological record cannot bear.

The examples we have considered are representative of the Cambrian to Carboniferous interval, and are sufficient to suggest that radiometric dating may be radically and fundamentally flawed. Darwinian evolution is tied to these long ages and this was illustrated for the alleged evolution of fish into amphibians, which would have been coeval with the Brecon Beacon section. I suggest that the Brecon sequence built up at the Flood rate of about 3 metres of sediment every hour, with a pause of a week or two near the top. If this is true, then no fish ever evolved into any amphibian.

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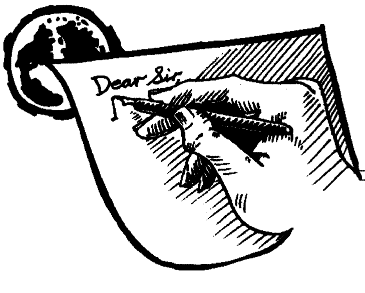

Correspondence

Renton MacLachlan

I was interested in Tony Rummery's article in *Origins* 5:14 on *Human Language. Part 2: Its Diversity.* I would just like to comment on his second last paragraph where he says that the confusion of languages at Babel is validated in the New Testament by the events recorded in Acts 2 and that this 'is surely Babel in reverse.' Can I suggest that a reversal of Babel would be a return to a single language situation, which Tony suggests will come in heaven, but which Acts 2 most definitely was not. The multiplicity of languages was not affected.

In fact, Tony's coining of the term *xenoglossia* to describe a situation where a person spoke a language they had never learnt is not justified by the text of Acts 2. Nowhere in the text does it say that those who spoke the various languages had not learnt them. I am aware that it is virtually universally assumed that this is, in fact, what happened, but it does not say so. The 'enabling of the Spirit' may have been something else which expressed itself in them speaking languages they already knew.

It is a controversial subject, as Tony mentions, however very few people seem able to cut through the semantic fog that surrounds it. I am hoping to publish later this year a paper that I am confident does clear the air in a very decisive manner.

I appreciate your journal.

Tony Rummery

A response to Renton McLachlan's letter.

Mr. McLachlan's first point is that the multiplicity of languages was not ended at Pentecost, and therefore it is not valid to refer to Pentecost as a 'Babel in reverse.'

While I do see his viewpoint and can go some way towards conceding the point, I would re-iterate that Pentecost

1. was a witness to the Church at that time that the Gospel was to go to all men (see also Acts 10:44–46 and 19:6) and
2. is a prophetic future pointer to that time when 'there shall be no more curse' (Rev 22:3 KJV).

Pentecost is a witness to God's sure and certain purpose that the judgement of Babel will indeed be reversed in glory. In a not dissimilar way, our Lord's resurrection does not mean that believers are exempted from death now, but was *inter alia* a witness

1. to the fact that in conversion a believer has been 'born anew to a living hope through the resurrection of Jesus Christ' (1 Pet 1:3) and
2. is a promise directing us forward to that day when 'the dead will be raised imperishable' (1 Cor 15:52).

His second point is to raise a question as to whether or not the events recorded in Acts 2 constitute a direct miracle of the Holy Spirit, or whether some means or second causes, such as a previous knowledge on the part of the Apostles and their associates of the languages they spoke is in view in the text.

Most commentators across a wide spectrum of evangelical constituencies take the events recorded in Acts 2, 10:44–46 and 19:6 as miraculous. That is the plain meaning of the words used, so the onus of proof rests with Mr. McLachlan to show that this was not the case. Furthermore, I would cite five compelling reasons for holding to the traditional assumption.

1. The incredible change of attitude in the disciples wrought by the Spirit at the same time that this gift was given.
2. The fact that other miracles are associated with the event, *i.e.* a 'sound ... from heaven like the rush of a mighty wind' (v.2), the 'tongues of fire' (v.3).
3. The fact that v.4 directly links the disciples' being filled with the Holy Spirit with their beginning to 'speak in other tongues.' We are not told of second causes in play at the time.
4. The fact that the onlookers were 'bewildered' (v.6) and 'amazed' and 'wondered' (v.7). Here were untutored men suddenly able to discourse in many different 'dialects': a bit like a person being able not just to speak English with a foreign accent, but with an exact regional dialect and using precise word forms and idioms of language. In fact, the word translated 'amazed' in the RSV text quoted above is in Greek *existanto.* Its root is the same as the root from which the English word 'ecstasy' is derived, such was the effect of this miracle on the onlookers. It seems hard to believe that such extreme language on the part of the inspired writer would have been used if the disciples were merely using a naturally acquired ability.
5. The inspired explanation of the event in vv. 17-21, quotes the prophet Joel and asserts the fulfilment of his prophesy. That of itself is an event of supernatural significance, and the passage quoted talks of supernatural activity such as 'prophesy,' 'visions' and 'dreams' (v.17 & 18) and 'wonders' and 'signs' (v.19) and links that with the outpouring of tongues on the Day of Pentecost.

My use of the word *xenoglossia* in the article was to apply a recognised linguistic term to the events described in Scripture as generally understood. That term is not one which I have invented myself, and I did not intend to imply that the use of the term *glossolalia* in theological study of this and the other applicable texts is necessarily wrong. The word *glossolalia* is not actually used anywhere in the Greek NT: it is a convenient term used in theology and Bible teaching as synonymous with the phrase 'speaking in tongues.' Its usage in linguistics implies 'unintelligible or ecstatic speech' whereas in Acts 2 we are told clearly that the disciples' *glossolalia* was understood by their hearers because the disciples were speaking real languages. The linguistic term *xenoglossia* therefore better describes that event.

J. H. John Peet

In the 4(10) issue of *Origins* I reviewed a book by David Fasold, 'The Discovery of Noah's Ark.' In his book, Mr. Fasold presented what he considered to be evidence in support of a 'new' location for Noah's Ark. He believes that he has found the remains of the boat in the rocks of the Ararat range in east Turkey. In the review, I expressed my feelings that the book was poorly written and I challenged some of the so-called evidence; I warned that I considered it dangerous because of its unbiblical stance. In his 'Ark-Update,' which Mr. Fasold kindly sent me, he included a copy of my review and his comments on it. I don't intend to respond to his defence, which he is entitled to do, but I would like to respond on the principles involved.

The author could not even get my name correct! Mr. Fasold attributes to me beliefs I neither claimed nor hold, *viz.* 'He obviously believes Noah was a Jew, carrying tablets in Hebrew (or possibly the King James Version of the Bible) aboard the Ark.' If that is the level of his scholarship, I think our readers will not need further elucidation. It is strange that Mr. Fasold should forcefully attack Dr. Morris and others for telling 'bold-faced lies' when he can be guilty of the same!

Mr. Fasold is very bitter towards Creationists and this comes out again in his response. However, he seems to be unaware of the principles of reviewing. Like any professional journal (and I review and referee for academic publications too), the reviewer is chosen as one who is considered to be an appropriate person in the light of the editorial position. *Origins* is an evangelical publication whose contributors have to accept the basis of faith of the Biblical Creation Society. I do not see any reason, therefore, to present arguments on the priority of Scripture. That is assumed by members who expect the reviewers to report on a publication in the light of the doctrinal statement of the BCS. This I sought to do.

We are a British publication and we use, therefore, English (not American) spelling, so he should not be surprised at that! I stand by my comments that I felt the book was badly written. I judge it as I do other professional publications that I have refereed and also as an educationalist. I am not necessarily impressed with media comments on it, though Fasold is obviously encouraged by them.

Mr. Fasold claims that the report I quoted by Dr. Morris is false and that Dr. Morris has refused to publish any retraction. Since I am not a party to that correspondence, I cannot comment on its accuracy. If it can be shown that Dr. Morris's claims are false, then obviously I will be happy to publish a retraction of that point. In the meantime, I still stand by my comments. Scientifically, I still believe that there is inadequate information in the text to judge the methods used. It is this methodology that seems to be at the heart of Dr. Morris's report.

However, I would mention that, contrary to Fasold's statements, our review was not influenced by Morris. The article by him came out after I first wrote the review and his comments seemed to be a useful addition. Indeed, the bulk of the review was unrelated to Dr. Morris' comments. This will serve as a further warning against the book and its author!

A further reason for returning to this subject is the intensive and extensive research done by Dr. Andrew Snelling of the Creation Science Foundation Ltd. and I thank them for permission to refer to their findings.

The investigative work on the site was performed in the 1980s by Ron Wyatt and then by David Fasold and John Baumgardner. The latter is a respected geophysicist. Both Fasold and Baumgardener have parted company with Wyatt. Fasold and Wyatt disagree on details rather than principle. Baumgardner has rejected the 'evidence' and has concluded that there is no evidence for the ark at this site. Wyatt has since been joined by Allen Roberts.

The CSF article is extensive and detailed (*Creation Ex Nihilo*, 1992, 14(4): 26–38). Snelling shows that the following claims by these workers are false:

— radar shows a man-made boat structure
— regular metallic pattern has been demonstrated
— petrified laminated wood has been identified
— metal rods were found
— ship's ribs are shown
— Turkish Commission confirms the identification as a boat.

More seriously—and related to our complaint—is the accusation that CSF are opposed to this find because they have a vested interest elsewhere. This type of character assassination is unbecoming of a serious writer, as well as being false. It reinforces our warnings against the book.

For the record, I did not say that I preferred the traditional site claimed for Noah's Ark—I think that Mr. Fasold's judgment on this point could be right, but that was not what I was addressing. Nor do I defend the position of the 'fundamentalists' he attacks. As I said in the review, I think he may have a legitimate cause for criticism sometimes.

ORIGINS
• Journal of the Biblical Creation Society •

Origins is published twice a year by the
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ISSN 0953-2773

Printed by Inkon Printers Oldham Street Hyde Cheshire SK14 1LL Tel: 061-368 3444